University of Alberta

Relationship Between Leisure Time Physical Activity and Psychosocial Well-Being in Adolescents Following Cancer Diagnosis

by

Melanie R. Keats

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Masters of Science

Faculty of Physical Education and Recreation

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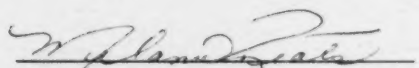

5011 Taunton Road NW
Calgary, Alberta, CANADA
T2K 2X5

April 14, 1999

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommended to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled *Relationship Between Leisure Time Physical Activity and Psychosocial Well-Being in Adolescents Following Cancer Diagnosis* in partial fulfillment of the requirements for the degree of *Master of Science*.

Supervisor, Kerry S. Courneya, Ph.D.

Robert Sinclair, Ph.D.

John Spence, Ph.D.

Susan Danielsen, Ph.D.

APRIL 14, 1999
Date

Dedication

To all those diagnosed with cancer,

particularly to those diagnosed at an early age.

I hope that my work today and the work that precedes me

will assist those in better understanding the implications of

their disease and provides them with a tool to better cope with

all that the diagnosis of cancer brings.

Abstract

This preliminary study examined the relationship between leisure time physical activity (LTPA) and psychosocial well-being in 53 adolescent cancer survivors. Each participant completed a mailed, self-administered questionnaire that assessed their LTPA at three time points (pre-diagnosis, active treatment, and post-treatment), and their current psychosocial well-being. Analysis of the data revealed that the adolescents exhibited four main LTPA patterns across the cancer experience which were labeled *maintainers* (active at all three time points), *temporary relapsers (*active pre-diagnosis, inactive during treatment, active post-treatment), *permanent relapsers (*active pre-diagnosis, inactive during treatment, inactive post-treatment), and *non-participants* (inactive at all three time points). A mutivariate analysis of variance indicated that current psychosocial well-being differed significantly across the four patterns. Follow-up univariate analyses of variance revealed significant differences for the psychosocial constructs of general self, physical abilities, parental relations, same sex relations, and opposite sex relations with effect sizes ranging from medium-large to large. Post hoc tests generally showed that the *maintainers* exhibited superior scores of psychosocial well-being compared to the other three LTPA patterns. It was concluded that LTPA pattern across the cancer experience may be related to psychosocial well-being in adolescent cancer survivors but that further research is required.

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Chapter 1

Cancer is the leading cause of potential years of life lost in Canada, with an estimated 889,000 years lost per year (National Cancer Institute of Canada, 1995). It is estimated that 130,000 Canadians will be diagnosed with cancer in 1998 and approximately 62,700 will die from the disease (National Cancer Institute of Canada, 1998). Although cancer is considered a rare occurrence among children and adolescents (as compared to adults), it is second only to accidents as the leading cause of death in the age group five to 19 years (Hutchcroft, Clarke, Desmeules, et al., 1996). It is estimated that in 1998, over 1400 Canadian children and teenagers will be diagnosed with cancer and approximately 205 will die from it (National Cancer Institute of Canada, 1998).

Exercise and Cancer - An Overview

Adolescence is a time marked by a number of physiological, cognitive, and social changes as well as by a prevalent need for interpersonal intimacy. For the adolescent with cancer these natural physical, psychological, and social changes are compounded by the cancer experience. The impact of diagnosis and its associated treatment often results in a number of negative side effects that impinge on psychosocial well-being. Although some have suggested that adolescents can be very resourceful and cope very well (Kellerman, Zeltzer, Ellenberg, Dash, & Rigler, 1980), many display an increased tendency towards problems with peer relationships (e.g., Pendley, Dalhquist, & Dreyer, 1997), depression (e.g., Kashani & Hakami, 1982), altered perceptions of self and body image (e.g., Puukko, Hirvonen, Aalberg, Hovi, Rautonen, & Siimes, 1997) , and a move towards an external locus of control (e.g., Jamison, Lewis, & Burish, 1986).

Compounding these psychosocial concerns are the physical and functional side effects associated with cancer treatment. These include reduced cardiovascular and pulmonary function (Jenney, Faragher, Morris, & Woodcock, 1995), decreased exercise tolerance/work load (Sharkey, Carey, Heise, & Barber, 1993), impaired muscle strength (Hovi, Pertti, Rautonen, Martti, & Siimes, 1993), and an increased risk of obesity (Turner-Gomes, Lands, Halton, et al., 1996).

As noted by Courneya and Friedenreich (1997a, 1997b), many of the current quality of life interventions for cancer patients/survivors focus largely on psychological well-being and are less likely to address the physical and functional problems that underlie overall psychosocial well-being. Moreover, Cella and Tulsky (1990) have noted that functional and physical well-being are considered by many to be essential dimensions of overall quality of life. Additional support for these findings has been provided by Courneya and Friedenreich where a group of breast (1997a) and colorectal (1997b) cancer survivors identified that functional quality of life was the least possessed but most important quality of life dimension underlying overall satisfaction with life.

A potential intervention therapy that may address this broad range of psychosocial and physiological needs of the adolescent cancer survivor is physical activity. A strong theoretical basis for the use of physical exercise as a quality of life intervention has been outlined by Hicks (1990). Within the healthy adult population physical exercise is associated with numerous psychological and physiological benefits that are typically diminished in cancer patients, including cardiovascular fitness (Mitchell & Raven, 1994), pulmonary function (Babcock & Dempsey, 1994), anxiety (Landers & Petruzzello, 1994),

depression (Morgan, 1994), and self-esteem (McAuley, 1994). Moreover, physical exercise has already demonstrated its effectiveness for the rehabilitation of patients of other chronic diseases such as cardiovascular disease (Kavanagh, 1994), essential hypertension (Goldberg & Elliot, 1994), rheumatic disease (Clark, Burckhardt, & Bennett, 1994), diabetes mellitus (Campaigne, 1994), pulmonary disease (Barker, 1994), and end stage renal disease (Painter, 1994).

A limited amount of research in adult cancer patients is available to show that physical exercise may be beneficial during the cancer experience. A recent review by Courneya and Friedenreich (in press) concluded that physical exercise has been shown to have a positive effect on quality of life in adults following cancer diagnosis, including physical, functional, psychosocial, and emotional well-being. The preliminary, yet positive nature of these findings, provides a strong rationale for extending this research to adolescents with cancer.

Moreover, research has shown that physical exercise in healthy adolescents improves self-esteem and physical self-concept (Boyd & Hrycaiko, 1997), contributes to positive family affiliation (Foon, 1989), decreases the negative impact of stressful life events (Brown & Seigal, 1988), increases self-efficacy (Brown, Welsh, Labbe, Vitulli, & Kulkarni, 1992), decreases feelings of depression and anxiety (Norris, Douglas, & Cochrane, 1992), promotes social competence (Weiss, Smith, & Theeboom, 1996; Martinek & Hellison, 1997), and improves physiological functioning (Baxter-Jones & Helms, 1996). For a more thorough review of all of the psychosocial and physiological data presented here refer to Appendices A-I.

Purpose

The primary purpose of the proposed study was to examine the relationship between leisure time physical activity (LTPA) and psychosocial well-being in adolescent cancer survivors. A secondary purpose was to uncover the perceived barriers to LTPA while undergoing treatment, strategies to overcome these barriers, and what activities these adolescents would view as most appropriate for future intervention studies.

Hypothesis

Based on previous investigations on exercise and psychosocial well-being in the healthy adolescent population as well as in the adult cancer population, it was hypothesized that LTPA would be positively related to psychosocial well-being in adolescent cancer survivors. Moreover, based on recent studies by Courneya and Friedenreich (1997a, 1997b), it was hypothesized that it would be the pattern of LTPA across the cancer experience (i.e., pre-diagnosis, during treatment, and post-treatment) that was most closely associated with psychosocial well-being. In particular, it was expected that those adolescents who maintained LTPA throughout the cancer experience would also report the best psychosocial adjustment.

Chapter 2

Methods

Participants

Participants in the study were 53 adolescent cancer survivors who were diagnosed between 1992 and 1997 in Alberta, Canada and were (a) between the ages of 12 and 18 years when diagnosed, (b) between 12 and 19 years at the time of completion of the survey, and (c) had received active physician approval to participate. A total of 121 participants met the selection criteria and 110 (91%) were given active physician approval to be contacted for potential study recruitment. Reasons for not obtaining physician approval were: failure to contact the physician after multiple attempts (5), patient deceased/near death (3), deemed as a "sensitive" case by physician (2), and severely mentally handicapped (1). Of the 110 eligible participants contacted, 89 were between the ages of 16 and 19, 20 were between the ages of 12 and 15, and 2 were not identified by age. Upon completion of data collection 54 surveys were returned, three were turned back marked address unknown, and one provided incomplete data. The response rate for those between 16 and 19 was 54.1% (46/85; three returned address unknown) and 40% (8/20) for those between 12 and 15 years of age. The overall response rate was 50.5% (54/107).

Procedures

Eligible adolescent cancer patients/survivors were identified through the Alberta Cancer Registry and Northern Alberta Children's Cancer Program (NACP). Those patients who received physician approval were mailed a self-administered survey package

which included a detailed cover letter outlining the objectives of the study, two informed consents, a questionnaire package, and a self-addressed stamped envelope. Consent from the parent (for those under 18 years) and assent/consent from the adolescent were required for study participation. The mail protocol was based on a slightly modified version of the Total Design Method (Dillman, 1983). The protocol consisted of: (a) mailing the initial questionnaire packet, (b) mailing a postcard reminder 11 days later, and (c) mailing a second questionnaire packet 26 days later to all those who did not respond to the first mailing and the postcard reminder. This research protocol was reviewed and approved by the Alberta Cancer Board, The Child Health Research Office, The University of Calgary's Biomedical Ethics Board, and the University of Alberta's Health Ethics Review Board.

The survey methodology of the present study included a number of features designed to increase response rates including multiple reminders (i.e., postcard, second questionnaire), stamped return envelopes, a personalized cover letter outlining the researcher's experience with cancer as an adolescent, colored paper, illustrations, and assurances of confidentiality (Ransdell, 1996). In consideration of the tendency of these adolescents to under-report problems and over report psychosocial well-being (Pukko et al., 1997a; Pukko et al., 1997b), all correspondence was addressed to the adolescent participant with the assurance that all information was to be held in strict confidence and with the exception of obtaining informed consent, no part of what the adolescent chose to disclose would be made available to parents or any others not directly associated with this study. However, if the adolescent felt that they would like to further explore their

thoughts and feelings, they were encouraged to do so. Contact names and numbers for the primary investigator as well as two clinical pediatric psychologists were provided.

In addition to completing the questionnaire, five adolescents identified through the NACP participated in a semi-structured, small group discussion. The goal of this discussion group was to address relevant LTPA related concerns/issues within a focus group setting.

Measures

Background Information included demographic and medical characteristics (Appendix O). The demographic characteristics were self-reported and consisted of age, sex, grade level, height, and weight. Participants were asked to answer the demographic questions based on their current status. The medical information was also self-reported and included month and year of diagnosis, type of cancer, and type and weeks of adjuvant therapy.

Leisure Time Physical Activity. In an attempt to eliminate bias, the LTPA questionnaire was presented to the participants as a *"Leisure Time Activities"* survey (Appendix P). That is, they were asked to report any leisure time activities (e.g., art, dance, music) that they may have been or were currently enrolled in at the time of completing the survey. Thus, all participants had an equal opportunity to report some form of leisure time activity.

Two types of LTPA were assessed. The first, *Leisure Time Exercise Behavior* was assessed by a slightly modified version of the leisure score index (LSI) of the Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin, Jobin, & Bouillon, 1986; Godin

& Shepard, 1985). The LSI contained three questions which assessed the frequency of mild, moderate, and strenuous exercise performed for at least 15 minutes of duration during free time in a typical week. A total LSI can be calculated by weighting each frequency by its estimated intensity in METS [a unit which represents the metabolic cost (oxygen consumption) of physical activity] and summing for a total score as follows: (3 x mild) + (5 x moderate) + (9 x strenuous). An independent evaluation of this measure found it to be easily administered, brief, reliable, and to possess concurrent validity based on various criteria including objective activity monitors and fitness indices (Jacobs, Ainsworth, Hartman, & Leon, 1993). Participants were asked to complete the LSI recalling three different time periods: pre-diagnosis (i.e., the months prior to diagnosis), during treatment (i.e., while undergoing adjuvant therapy), and post-treatment (i.e., the months since adjuvant therapy). A test-retest coefficient of .84 has been reported for children and adolescents (Sallis, Buono, Roby, Micale, & Nelson, 1993). The GLTEQ has previously been utilized with cancer survivors (Courneya & Friedenreich, 1997a; Courneya & Friedenreich, 1997b).

In addition to the GLTEQ, a second measure, the *Organized Sports Survey,* was designed to identify the different sports these adolescents were choosing as means of physical activity. Specifically, the adolescents were asked to report the number of organized sports in which they participated, the average number of games/practices per week, and the average length of the season.

Depression was assessed by the Centre for Epidemiological Studies Depression (CES-D) scale which is a well-validated, 20 item scale that measures the frequency of

depressive symptoms over the past week (Radloff, 1977; Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977) (Appendix R). The scale was not intended for diagnostic purposes, but rather as a state measure of current feelings of general depression. It was designed to provide an index of the cognitive, affective and behavioral features of depression and the frequency with which these symptoms occur. Items are scored from 0 (<1 day) to 3 (5-7 days) and summed to provide an overall score (i.e., 0 to 60). A cutoff score of 16 or greater has been used to denote individuals who may need diagnostic follow-up for clinical depression. Several studies have utilized and validated the use of the CES-D for the adolescent population, including respondents as young as junior high school (Radloff, 1991; Garrison, Schluchter, Schoenbach, & Kaplan, 1989; Schoenbach, Kaplan, Grimson, & Wagner, 1982; Weissman, Orvaschel, & Padian, 1980). Schoenbach et al., (1982), Garrison et al., (1989), and Radloff (1991) all found an average coefficient alpha of .86, demonstrating that the CES-D has good internal consistency. The internal consistency of the scale in the present study was acceptable (α= .81).

Locus of Control was assessed by Multidimensional Health Locus of Control Scale (MHLC) (Wallston, Wallston, & DeVillis, 1978) (Appendix S). The MHLC was utilized to assess the source of reinforcements for health related behaviors as primarily internal (IHLC), a matter of chance (CHLC), or under the control of powerful others (PHLC). Two parallel forms of this 18-item questionnaire are designed to measure locus of control using a six point scale ranging from "strongly disagree" to "strongly agree". Three scale scores are obtained, one measuring internal locus of control and two

measuring external locus of control. The scores for each scale range from 6 to 36. The MHLC has been used in both the adult (Bremer, Moore, Bourbon, Hess, & Bremer, 1997) and adolescent cancer populations (Jamison et al., 1986, Kellerman et al., 1980). Item alpha reliability of these two versions range from 0.67 to 0.77 (Wallston, Wallston, & DeVellis, 1978). The current study found low internal consistencies (alphas) for all three sub-scales and selected items were deleted in an attempt to improve the alpha levels. Coefficient alphas were .65 for IHLC (item 8 deleted), .64 for PHLC (item 7 deleted), and .59 for CHLC (item 4 deleted). Due to the poor internal consistency of this scale within the present study further analysis were not conducted.

Self-Concept was assessed by the Self-Description Questionnaire - II (SDQ-II) developed by Marsh (1992) (Appendix T). The questionnaire was designed to be a self-explanatory measure of self-concept in younger adolescents (grades 7 through 12). The SDQ is based on a multifaceted, hierarchical model proposed by Shavelson, Hubner, & Stanton (1976), in which general self-concept appears at the apex and is divided into academic and non-academic self-concepts. The 102-item SDQ-II assesses three areas of academic self-concept, seven areas of non-academic self-concept, and general self-concept. For the purposes of this study seven of the 11 scales (62 items) were deemed potentially relevant from an LTPA perspective and were utilized. They included measures of: *Physical Abilities; Physical Appearance; Opposite-Sex Relations; Same-Sex Relations; Parent Relations; Emotional Stability; and General Self-Concept.*

In completing the SDQ-II, adolescents were asked to respond to simple declarative statements (e.g., "I have a good looking body," "I can run a long way without

stopping") with one of six responses: False; Mostly False; More False Than True; More True Than False; Mostly True; or True. Each of the scales were based on the adolescent's self-ratings on 8-10 items, half of which were negatively worded in order to disrupt positive response biases. The coefficient alpha estimate of reliability for each SDQ-II scale is high, varying from .83 to .91, whereas the correlation among the factors is modest (mean r = .18). Internal consistencies in the present study were acceptable: emotional stability (∝=.88), general self (∝=.81), physical abilities (∝=.83), physical appearance (∝=92), parental relations (∝=.90), same sex relations for males (∝=.81) and females (∝=.80), opposite sex relations for males (∝=.89) and females (∝=.89), total same sex relations (∝=.87), and total opposite sex relations (∝=.92).

Open-Ended Survey and Focus Group Questions were assessed by open-ended questions. The LTPA advantages and disadvantages questions asked, "What do you feel are the main advantages/disadvantages of LTPA while receiving cancer treatment?". Questions covering the perceived barriers and strategies to overcome those barriers asked, " What do you feel are the biggest problems towards LTPA while undergoing treatment?" and "What could be done to help people exercise while undergoing treatment?". Additional questions asked the adolescents to identify the most important people in their lives when thinking about LTPA while undergoing treatment and to list LTPA preferences (e.g., type of LTPA, location, intensity).

Analysis

Internal consistencies were initially calculated for the Self-Description Questionnaire, the Multidimensional Health Locus of Control Scale, and the Center for

Epidemiological Studies - Depression Scale. Descriptive statistics, based on demographic and medical variables, were also calculated to provide more information regarding the participants of this study. Pearson correlations as well as one-way analysis of variance (ANOVA) were used to examine the relationship between the demographic/medical variables and the physical activity and psychosocial variables. In addition, independent t-tests were used to analyze the relationship between participation in organized sport and psychosocial well-being throughout the cancer experience. The hypothesis was examined by first computing overall MANOVAs followed by univariate analysis of variance (ANOVAs) based on the main physical activity patterns (leisure time exercise and organized sport behavior were analyzed separately) and current psychosocial well-being. Lastly, Least Significant Difference post hoc tests and effect sizes were calculated to determine which patterns differed and what percentage of the variance was accounted for by the various LTPA patterns. Analysis of the responses to the open ended questions in the questionnaire and the focus group data entailed a summary of repeating themes and comments.

Chapter 3

Results

Participants' Characteristics

Details of the demographic and medical characteristics of the participants are presented in Table 1. The mean age of the 53 participants, 28 boys and 25 girls, was 17.3 years (SD = 1.65 years). Twenty-two of the adolescents had completed high school and more than 60% of those indicated that they were continuing on with some form of post-secondary education. The remaining 31 participants were still attending either junior or senior high school. As anticipated the three most common diagnoses included some form of Lymphoma or Hodgkin's Disease (32.1%), leukemia (22.6%), and tumors of the central nervous system (15.1%). Other diagnoses included osteosarcoma (9.4%), soft tissue malignancies (9.4%), thyroid (3.8%), breast (1.9%), carcinoid (1.9%), and Wilm's Tumor (1.9%). The mean number of months since diagnosis was 33.1 months (SD = 18.9 months). The primary surgical treatment for half (50.1%) of the adolescents was a biopsy or partial/complete removal of the tumor, and almost all (94.3%) received some form of adjuvant therapy either alone or in combination with another therapy. The mean number of weeks of adjuvant therapy was 14.9 (SD = 22.3). Eight participants (15.1%) were still undergoing treatment at the time of completion of the survey, however, four of those reported some form of post-treatment LTPA. It was assumed that these four participants (all of whom were diagnosed with some form of leukemia) were indicating participation in LTPA during the often lengthy periods of time between treatments.

Table 3-1

Demographic and Medical Characteristics of the Study Participants (n = 53)

Characteristic	Number	Percentage
Gender		
Male	28	52.8
Female	25	47.2
Age		
12 - 13	01	1.9
14 - 15	06	11.3
16 - 17	19	35.8
18 - 19	27	50.9
Education		
Grades 8 & 9	05	9.4
Grades 10, 11, & 12	24	45.3
Completed high school	08	15.1
Some university/college	14	26.4
Data Missing	02	3.8
Diagnosis		
Lymphoma/Hodgkin's Disease	17	32.1
Leukemia	12	22.6
Central Nervous System	08	15.1
Other	15	28.3
Data Missing	01	1.9
Type of Surgery		
Biopsy or partial/complete tumor removal	27	50.9
Musculoskeletal/amputation	04	7.5
No surgery	09	17.0
Other	08	15.1
Don't know	05	9.4
Type of Adjuvant Therapy		
Chemotherapy alone	17	32.1
Radiation alone	12	22.6
Chemotherapy plus radiation	13	24.5
Chemotherapy and/or radiation plus bmt/sct	08	15.1
No adjuvant therapy	03	5.7

Physical Activity and Psychosocial Well-Being

Descriptive statistics for each level of LTPA across the cancer experience as well as current psychosocial well-being outcomes are presented in Table 2. Identification of the exercise patterns across the cancer experience required that the participants be categorized as "inactive" or "active" at the three relevant time points (i.e., pre-diagnosis, during treatment, post-diagnosis). A cut point of 27 METs of total exercise per week was selected as the criterion. Using examples for a single intensity level, this criterion could be met by the accumulation of 9 mild (3 METs each), 6 moderate (5 METs each), or 3 strenous (9 METs each) exercise sessions per week. Other combinations across the intensity levels could also meet the criterion. Although any cut point is arbitrary, this level of activity exceeded the amount recommended for fitness benefits (ACSM, 1998) thus allowing for any tendency to over-report exercise frequency. Based on the 27 MET criterion, 81.1% of the participants were active at pre-diagnosis, 32.1% were active during treatment, and 71.4% were active post-treatment. The three time points (i.e., before, during, and after cancer treatment) combined with the two activity patterns (i.e., active and inactive) resulted in eight possible exercise patterns. Examination of the patterns however, revealed that 90% of the participants fell into four main exercise patterns (Table 3). The four main exercise patterns were labelled *maintainers* (MT) (active at all three time points), *temporary relapsers* (TR) (active pre-diagnosis, inactive during treatment, active post-treatment), *permanent relapsers* (PR) (active pre-diagnosis, inactive during treatment, inactive post-treatment), and *non-participants* (NP) (inactive at all three time points).

Table 3-2

Descriptive Statistics for Leisure Time Physical Activity and Psychosocial Well-Being.

Item	Mean	Standard Deviation
Before Diagnosis		
Total Exercise	81.26	81.53
Average # of OS	1.49	1.38
Total OS sessions/year	91.27	124.49
During Treatment		
Total Exercise	26.20	36.99
Average # of OS	0.51	0.97
Total OS sessions/year	35.69	103.79
After Treatment		
Total Exercise	79.02	92.92
Average # of OS	0.59	0.98
Total OS sessions/year	49.20	115.13
Depression	12.41	8.46
General Self	53.74	5.18
Emotional Stability	41.48	10.06
Physical Appearance	37.37	8.47
Physical Abilities	36.76	7.23
Parental Relations	40.26	7.94
Total Same Sex Relations	72.57	9.25
Total Opposite Sex Relations	59.34	10.06

Note: OS = organized sport

Table 3-3

Total Number and Percentage of Adolescent Cancer Survivors in Each of the Eight Possible Leisure Time Exercise and Organized Sport Patterns Across the Cancer Experience.

	Major Time Points			LTE		OS	
Activity Pattern	Before	During	After	N	%	N	%
1. Maintainers	Active	Active	Active	13	27%	07	14%
2.	Active	Active	Inactive	01	02%	05	10%
3. Temporary Relapsers	Active	Inactive	Active	19	39%	07	14%
4. Permanent Relapsers	Active	Inactive	Inactive	06	12%	13	27%
5.	Inactive	Active	Active	00	00%	00	00%
6.	Inactive	Active	Inactive	01	02%	00	00%
7.	Inactive	Inactive	Active	03	06%	04	08%
8. Non-participants	Inactive	Inactive	Inactive	06	12%	13	27%
Total				49	100%	49	100%

Note: LTE = Leisure Time Exercise; OS = Organized Sport

The identification of the organized sport patterns across the cancer experience was similar to that of the leisure time exercise patterns. However, rather than establishing an exercise criterion (e.g., 27 METS), participants were simply categorized as "inactive" or "active" based on their "yes/no" response to participation in organized sport at the three time points (i.e., before, during, and after cancer treatment). Based on the participants' responses, 67.9% were involved at pre-diagnosis, 28.3% were involved during treatment, and 34.0% were involved post treatment. Again, the combination of the three time points and the two activity levels resulted in eight possible activity patterns. However, like the exercise patterns, examination of the numbers revealed that 82% of the participants fell into four main organized sport patterns. The organized sport patterns were labelled the same as the leisure time exercise patterns (see Table 3).

Outcomes of the Main Hypothesis

Relationship Between Leisure Time Exercise During and Post Treatment and Psychosocial Well-Being.

Correlational analysis of total leisure time exercise behavior and psychosocial well-being outcomes showed a significant relationship in the hypothesized direction for physical abilities both during ($r = .28$) and after treatment ($r = .31$) (Table 4).

Relationship Between Organized Sport Behavior During and Post Treatment and Psychosocial Well-Being.

Correlational analysis of the number of organized sport sessions per year and psychosocial well-being outcomes demonstrated a significant relationship in the hypothesized direction for physical appearance ($r = .24$) and physical abilities ($r = .26$)

Table 3-4

Pearson Correlations Between Leisure Time Physical Activity and Psychosocial Well-Being

	CES-D	GS	ES	PHAPP	PHAB	PR	SSR	OSR
Leisure Time Exercise								
During Treatment (n=53)								
Total LSI	.01	.02	-.08	.08	.28*	.03	-.08	-.07
After Treatment (n=49)								
Total LSI	.04	.10	-.16	.09	.31*	-.02	-.06	.00
Competitive Sports								
During Treatment (n=53)								
# Competitive Sports	.03	-.05	-.00	.04	.03	.06	.13	-.00
# Sessions/Year	.05	.10	.05	.24*	.26*	.09	.22	.23
After Treatment (n=49)								
# Competitive Sports	-.09	.27*	-.07	.31*	.48**	.14	.21	.36**
# Sessions/Year (n=45)	-.01	.17	-.07	.31*	.44**	.07	.29*	.37**

Note: ** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).
CES-D = Center for Epidemiological Studies Depression Scale; GS = General Self; ES = Emotional Stability; PHAPP = Physical Appearance; PHAB = Physical Abilities; PR = Parental Relations; SSR = Same Sex Relations; OSR = Opposite Sex Relations.

during treatment and physical appearance (r = .31), physical abilities (r = .44), same sex relations (r = .29), and opposite sex relations (r = .37) after treatment (taking into account the number of sessions per year). Correlational analysis which took into account the number of organized sports participated in for one year found significant relationships in the hypothesized direction for general self (r = .27), physical appearance (r = .31), physical abilities (r = . 48), and opposite sex relations (r = .36) following cancer treatment (see Table 4). Independent samples t-test of the organized sport data revealed a significant relationship between those participants who did or did not choose to participate in organized sport at the two time points (i.e., during, and after cancer treatment) with psychosocial well-being. Those who participated in organized sport post-treatment had significantly greater scores on physical abilities (t = 2.84; p = .007) and physical appearance (t = 1.95: p = .027) (Table 5).

Analysis of Physical Activity Patterns and Psychosocial Well-Being.

The relationship between the four main exercise and organized sport patterns and current psychosocial well-being was examined using a MANOVA with the LTPA pattern as the independent variable and the eight psychosocial constructs as the dependent variables. The MANOVA did not reach significance [Wilks's Lambda = .59; F(24,96) = .80, p = .73] for the four main exercise patterns. Further analysis using univariate ANOVAs also failed to demonstrate significance. However, an examination of the means indicated that MTs consistently exhibited superior scores on most measures as compared to TRs, PRs, and NEs.

The MANOVA did reach significance for the four main organized sport patterns

Table 3-5

Psychosocial Well-Being of Adolescents Who Did or Did Not Choose to Engage in Organized Sports Pre, During, and Post Treatment (n=53).

		During Treatment		Post-Treatment	
		Yes	No	Yes	No
Depression	M	11.19	12.90	11.78	12.13
	SD	7.77	8.76	7.85	9.13
Emotional Stability	M	41.07	41.64	40.81	42.06
	SD	10.12	10.16	6.96	12.00
General Self	M	54.15	53.57	54.83	53.48
	SD	6.31	4.74	5.51	4.61
Physical Abilities	M	38.73	35.98	40.19 *	34.67
	SD	7.52	7.06	5.97	6.89
Physical Appearance	M	38.95	36.74	40.08 *	35.27
	SD	8.79	8.38	5.02	9.68
Opp. Sex Relations	M	60.42	58.91	62.76	57.94
	SD	13.73	8.38	8.15	10.38
Same Sex Relations	M	75.53	71.40	74.56	72.10
	SD	9.45	9.03	7.90	10.19
Parental Relations	M	41.07	39.95	41.94	39.75
	SD	8.22	7.92	7.30	8.57

Note: * significant at the 0.05 level

[Wilks's Lambda = .28; F(24,85) = 1.96, p = .013] and further exploratory analyses were conducted. First, univariate ANOVA's were calculated and showed significant differences among the four organized sport patterns for general self [F(3,36) = 3.81, p = .02)], physical abilities [F(3,36) = 3.95, p = .02], opposite sex relations [F(3,36) = 7.19, p = .001], same sex relations [F(3,36) = 5.23, p = .004], and parental relations [F(3,36) = 3.84, p = .02). No significance was noted for depression [F(3,36) = .89, p = .46], emotional stability [F(3,36) = 1.44, p = .25], or physical appearance [F(3,36) = 1.50, p = .23]. LSD post hoc analyses showed that organized sport MTs exhibited significantly ($p < .05$) greater scores on general self and opposite sex relations than TRs, PRs, and NPs. MTs also demonstrated superior scores on physical abilities as compared to PRs, same sex relations as compared to TRs and NPs, and parental relations as compared to NPs.. Table 6 presents the mean and standard deviations for the psychosocial outcomes across the four organized sport patterns along with the F values, p levels, effect sizes, and post hoc results.

In an attempt to determine if the demographic or medical variables might explain the relationship between the LTPA patterns and psychosocial well-being ANOVAs and Pearson correlations were calculated. The results indicated that there were no systematic differences or relationships between the demographic/medical characteristics and both LTPA and psychosocial outcomes which might account for any observed relationships between these two variables. In addition, an ANOVA was conducted to determine if the four organized sport patterns differed on any medical or demographic variables that may partially explain the results. No differences among the four organized sport patterns were

Table 3-6

Comparison of Psychosocial Well-Being in Adolescents Following Cancer Diagnosis Across the Four Main Organized Sports Patterns (n=40).

		MT (n=7)	TR (n=7)	PR (n=13)	NP (n=13)	$F_{3,36}$	p level	ω^2	Post hoc test
Depression	M	9.98	13.56	10.50	15.33	.89	NS	-.01	NA
	SD	8.48	6.82	7.39	11.01				
Emotional Stability	M	42.14	37.08	45.69	39.31	1.44	NS	.03	NA
	SD	8.13	4.24	11.03	11.65				
General Self	M	58.42	50.86	54.27	53.26	3.81	.018	.17	MT>TR,PR,NP
	SD	1.40	6.44	3.61	4.64				
Physical Abilities	M	43.00	37.42	32.21	36.92	3.95	.016	.18	MT>PR
	SD	5.86	6.70	8.63	4.84				
Physical Appearance	M	43.14	37.80	35.45	36.08	1.50	NS	.04	NA
	SD	3.84	4.58	11.01	7.94				
Opp. Sex Relations	M	69.71	59.00	63.15	54.54	7.19	.001	.32	MT>PR>NP
	SD	3.30	7.51	6.20	9.45				MT>TR
Same Sex Relations	M	81.71	70.71	76.31	68.23	5.23	.004	.24	PR>NP
	SD	2.98	4.75	8.00	10.45				MT>TR,NP
Parental Relations	M	45.14	37.86	44.00	36.32	3.84	.018	.18	MT,PR>NP
	SD	3.58	9.60	3.61	9.33				

Note: M = mean; SD = standard deviation; MT = maintainers; TR = temporary relapsers; PR = permanent relapsers; NP = non-participant; NS = non-significant; NA = not applicable; ω^2 = Effect size based on formula provided by Tolson (1980).

found for any potentially relevant continuous demographic/medical variables including age, weeks of cancer therapy, and months since diagnosis

Overview of Open-Ended Survey and Focus Group Responses.

Five participants who completed and returned the mail-out survey were invited to participate in a focus group by a member of the NACP's psychosocial team. All five agreed to participate. The ages of the five participants, four female and one male, ranged from 16 to 19 years (16, 17, 17, 18, and 19). This semi-structured focus group, lasting 120 minutes, consisted of open-ended questions designed to further explore the relationship among the impact of cancer diagnosis, physical activity, and psychosocial well-being. The group was held in a private interview room at the Cross Cancer Institute and was conducted under the guidance and assistance of a familiar and trusted member of the pediatric psychosocial team.

In response to the first question of "what are the biggest problems toward LTPA while undergoing cancer treatment", the two most consistent responses included side effects from treatment (e.g., too tired, unable to get out of bed) and physician recommendations against physical activity (contributing to parental overprotectiveness). In addition, the adolescents commented on the overall lack of support for LTPA by the health care team and a lack of appropriate resources towards physical activity as a whole (e.g., what would and would not be appropriate activities and suitable substitions for one activity to another while undergoing treatment). As one respondent to the survey wrote, "Just the prospect of feeling better would have helped me, but you don't realize the benefits until you actually do it. The best motivation would have been lots of

encouragement". Other limiting factors to activity included: localized pain at cancer site, tendency to tire very quickly/no endurance, limited range of motion at surgery site, weight gain, time/scheduling constraints, and laziness. What was surprising to note however, was despite the general consensus of the theme of fatigue and listlessness, the adolescents commented that if they could just find a way to be even minimally active they all agreed that they usually felt better afterwards. In addition, all agreed that a long term goal was to increase their current LTPA levels.

As a follow-up to the first question, the adolescents were asked to suggest some strategies to overcome these barriers. Their responses included: needing some form of recreational facility within the hospital (need something to do other than just walking around the unit, "too boring"), support of family and friends, and by far the most important strategy would be to recruit the support of the physician. The adolescents could not stress strongly enough that what the physicians do or do not recommend is critical. They also expressed a desire for the physician to recognize them as a whole person and not simply a disease that requires treatment. Generally, they indicated a need for more and better explanations of what they can and cannot do within the constraints of their diagnosis.

When asked what activities these adolescents found most enjoyable their responses were very individual and consisted of both individual and team activities (e.g., swimming, hockey, weight lifting, kick-boxing, soccer, badminton, etc.). In response to the fourth question, identify the advantages and disadvantage to physical activity, the only real disadvantage was becoming overly fatigued while the advantages included looking

and feeling better, stress relief/relaxing, fun, and social networking. The responses to the final question of what type of environment would best suit their needs (i.e., structured, semi-structured, informal, group, individual) were again somewhat varied. As a whole, however, most agreed that they wanted their independence and having the choice of being able to do what they wanted when they wanted. They did, however, express a desire to participate in organized classes (e.g., aerobic) if they were made available.

When reviewing the comments made by the respondents to the survey, the general theme of their responses closely mirrored those of the focus group members. When asked to respond to the barriers to physical activity while undergoing cancer treatment, the most common response was a lack of energy or just not being well enough to participate. In response to the question of what strategies would be useful in overcoming these barriers, the survey respondents again reflected similar ideas as those expressed in the focus group (e.g., making available some form of recreational facility at the hospital and having the support of others). Although they did not specifically highlight the physician as the prime source of support (refer to Appendix U for important sources of social support), they did note that understanding the importance and benefits of LTPA as well as getting advice from professionals would be useful strategies. Furthermore, although they did not attribute the perceived support (or lack thereof) of the health care team (specifically the physician) as a barrier/strategy to physical activity, one respondent noted that doctors "should encourage patients to exercise as much as possible for them, not only for physical fitness, but also for emotional well-being. It's a good way to relieve stress." For a thorough overview of the responses to problems and strategies see Appendices V and W.

When analyzing the responses to the questions of what activities these adolescents found most enjoyable and listing the advantages/disadvantages of physical activity while undergoing treatment, their responses again closely mirrored the responses from those of the focus group. That is, both individual and team activities were reported as being enjoyable, the primary disadvantage to activity was that being active would be overly fatiguing/painful, and the primary advantage was staying fit/feeling better about oneself. For a complete listing of the participant responses to enjoyable activities and advantages and disadvantages refer to Appendices X, Y, and Z.

In response to the final question of what type of environment would best suit their needs the responses were, like the focus group, very individual. However, most of the respondents, 44.7% (n=21/47), indicated no preference between home, a fitness club/gym, or outdoors, while 27.7% (n=13/47) stated that they preferred to exercise outdoors, 17.0% (n=8/47) indicated a preference to work-out at a fitness center, and 10.6% (n=5) noted that they prefer to work out at home. In addition to exploring what type of environment would best suit their needs, the survey respondents were also asked to comment on how hard they like to work out and at what level, exercise preference (same vs different), exercise schedule (flexible vs scheduled), supervised vs non-supervised activities, and social aspects of exercise choice (i.e., alone, with friends, other survivors). Their responses are summarized in Appendix AA.

Chapter 4

Discussion

The purpose of the present study was to examine the relationship between LTPA and psychosocial well-being in adolescents following cancer diagnosis. The main findings of the study were that: (a) active treatment had a negative impact on LTPA that was not completely recovered post-treatment, (b) four major patterns of LTPA across the cancer experience emerged, and (c) maintainers exhibited superior scores on most measures of psychosocial well-being.

The first important finding of the present study was that adolescent cancer survivors reported a substantial decrease in both physical exercise and organized sport participation from pre-diagnosis to active treatment. The decrease in LTPA levels would most certainly be expected during active treatment given the documented negative side effects of cancer treatment, including nausea, fatigue, diarrhea, and pain (Winningham et al., 1994, Morrow & Dobkin, 1988, Ferrel, 1995). However, the increase in physical activity post-treatment was not sufficient to return to pre-diagnosis levels. Similar findings have been reported by Courneya and Friedenriech for breast (1997b) and colorectal (1997a) cancer survivors. This result indicates that following cancer diagnosis and its associated treatment, adolescents have still not completely returned to pre-diagnosis levels of LTPA. It is not clear from the present study, however, if this decrease in participation is due to the lingering effects of treatment or other factors (e.g., graduation from high school, therefore affording less opportunities for activity; and additional maturational aspects). For instance, as noted by the Student Survey Highlights

Report (Poon & Spence, 1997) while only 19% of high school adolescents 15 years and younger did not engage in some form of sporting activity 30.1% of the 18 year old students did not participate in some form of sport. Thus indicating a naturally occurring decline in sporting activity. Therefore, future research will require age-match control groups to provide a more definite answer to this question. As it is only through the use of such controls that maturational and other influences can be assessed.

Another important finding of the present study was the replication of the four main LTPA patterns across the cancer experience for both leisure time exercise and organized sport participation which was first reported by Courneya and Friedenreich (1997b). Like Courneya and Friendenreich (1997a, 1997b), only one major LTPA pattern included adolescents who were inactive pre-diagnosis. This pattern, labelled NP, consisted of individuals who remained inactive throughout the entire cancer experience and very few adolescents who were inactive prior to diagnosis become active either during or following treatment. Thus, it appears that the only way inactive adolescents might become active following cancer diagnosis is through some form of structured intervention program if such an intervention is warranted. Adolescents who are active at pre-diagnosis, on the other hand, exhibited three distinct LTPA patterns labelled MT, TR, and PR. One clear finding from the present study was that any adolescent who maintained LTPA during treatment would also maintain it post-treatment. Such information may be important to practitioners when considering the development of cancer rehabilitation programs.

Perhaps the most important finding was that the patterns of organized sport

activity had the most significant impact on overall psychosocial well-being. Significant differences among the sport patterns favoring the MTs were found for general self-concept, physical abilities, parental relations, same sex relations, and opposite sex relations. These are precisely some of the key psychosocial outcomes that have been found compromised in adolescent cancer survivors (e.g., Pendley et al., 1997; Puukko et al., 1997). Moreover, using Cohen's (1988, 1992) guidelines for the interpretation of effect sizes in the behavioral sciences, the relationships between LTPA and the various psychosocial outcomes may be interpreted as medium to large for general self-concept, physical abilities, and parental relations; and large for same sex relations and opposite sex relations. These results are noteworthy as Cohen's (1992, p. 156) interpretation of effect sizes explains that the values for medium effect sizes were chosen to "represent an effect likely to be visible to the naked eye of a careful observer."

One potential explanation for this finding may be related to the heterogeneity of patients in terms of their medical and demographic data (e.g., time since diagnosis, age, length of treatment). That is, those patients with more intensive or restrictive treatment regimes may be less inclined or able to participate in physical activities and may also be less adjusted psychosocially. However, within the scope of this study we were able to conclude that medical variables such as diagnosis, length and type of treatment, months since diagnosis, surgery type, and demographic variables such as age, gender, and grade had no systematic relationship with psychosocial well-being. It should be noted that this does not preclude the relevance or significance of other medical or demographic variables that were not assessed within the framework of the current study.

An important issue to discuss then, is why exercise pattern does not seem as important as organized sport when considering psychosocial well-being. One possible explanation may be related to the reliability of self-report assessments of LTPA levels. Based on the very nature of organized sport (e.g., set schedules, frequency, length of sessions), the reporting of involvement in most cases should be more reliable than attempting to recall individualized, non-scheduled leisure time exercise bouts. A second explanation may be that for many school aged adolescents organized school teams may represent the most predominant form of LTPA. A third explanation may be the additional impact of any perceived social support which may be readily available in an organized team setting. The significance of social support is that it has been believed to facilitate the coping process of dealing with the chronic anxiety associated with living with a potentially life threatening disease (Varni, Katz, Colegrove, & Dolgin, 1994). One respondent to the survey wrote, "I found that participating on a team was a real bonus...Once I was able to return to P.E. class and the sports I had played before I felt better." The concept of social support and support networks has been discussed often in the literature and although immediate and extended family members are still reported by adolescents as important providers of support, the importance of friends in the network increases during adolescence as does the amount of support received from these friends (Nichols, 1995). In fact, the results of the present study found that those adolescents choosing continued participation in organized sport (therefore, presumably providing greater social interaction with ones peer group) both during and after treatment, demonstrated better scores on both same sex and opposite sex relations as compared to

their counterparts who choose not to participate (Table 5).

An additional important question that must be raised then, is why do some choose to remain involved while some drop out. One potential explanation is again summarized well by the aforementioned respondent, "I wanted to return to ringette the year after my surgery, but the doctor told me to wait until the following season", thus many adolescents diagnosed with cancer seem not only to be limited by the stress of diagnosis and impact of treatments, but also due to a perceived lack of support of their prime health care providers (namely, the oncologist). Consistent with both the open-ended responses and even more so with the comments of the focus group, the importance of the physician could not be overstated. Not only did the adolescents report that they were not made aware of the benefits of LTPA, many were told to eliminate all activities for a specified time period after having undergone various treatment related procedures (e.g., one week after a broviac placement). A second possible explanation for those no longer attending school may be a lack of resources or the knowledge of how to regain access to LTPA opportunities outside of the school setting. Other possible explanations might include: fear of failure; fear of rejection or being mocked by peer group, fear of injury, and an inability to perform at pre-diagnosis levels.

Although, it may seem premature to speculate as to whether or not these differences in psychosocial well-being are solely due to differences in participation in LTPA, specifically organized sport, it does seem plausible to suggest that organized sport may provide invaluable opportunities for normalizing, age-appropriate, functionally and physically beneficial, socializing activities. That is, organized sport may afford the

adolescent with not only the clear physiological benefits of physical activity, but may also provide the adolescent cancer patient/survivor with an effective tool empowering them with the ability to take an active stance in coping with the stresses of cancer diagnosis. A review of the literature has consistently found that physical activity has a positive effect on the psychosocial well-being of adolescents (e.g., Brollier et al., 1994; Brown et al., 1992; Foon, 1989; Brown & Seigel, 1988). Clearly, future research using experimental, designs is necessary before any definitive conclusions can be drawn.

Practical Implications

Although these findings are preliminary, and several methodological limitations need to be addressed, their replication may have important practical implications for adolescent cancer rehabilitation programs. According to the present study it seems that those individuals who are able to remain physically active across the cancer experience also reported superior psychosocial well-being. Thus it seems that rehabilitation programs should emphasize the importance of continuing to be physically active throughout the cancer experience and avoiding LTPA relapse if at all possible. More specifically, it seems imperative that the health care team, most notably the oncologist, take a more active role in equipping the adolescent and their parents with the appropriate knowledge, such as the benefits of regular LTPA, the ability to modify or substitute more appropriate LTPA and setting realistic goals based on their disease status and treatment protocol, providing access to and identifying appropriate resources, and perhaps most importantly providing ongoing encouragement and support towards the maintenance of an active lifestyle. Moreover, it seems important that rehabilitation programs be designed

specifically for the adolescent as it seems clear that young adults with cancer present themselves with many unique needs that are of little or no relevance to their older counterparts.

It is important to note however, that this study does not have any implications for adolescents who are inactive pre-diagnosis since the only pattern that emerged for this group was continued inactivity across the cancer experience (i.e., NE pattern). As noted in a similar study within the adult colorectal cancer population (Courneya & Friendenreich, 1997a), a comparison of the NE pattern to those who were active pre-diagnosis does not address the question of what should be recommended for inactive adolescents. The question becomes then, "is there any benefit to previously inactive adolescents initiating some form of LTPA either during or following cancer treatment." Future research will be instrumental in determining what, if any, benefits might arise from introducing LTPA during and post-treatment to those adolescents who were inactive pre-diagnosis.

Study Limitations, Improvements, and Future Directions

Despite the important findings of the present study, several limitations need to be considered when interpreting the findings and planning future research. First, a retrospective, cross-sectional design was used. The retrospective design required the adolescents to recall their physical activity levels over a period of up to six years (mean=2.76 years). Furthermore, due to the very nature of cross-sectional designs, cause and effect cannot be established. Thus, future research should incorporate the use of prospective and experimental designs before any definitive conclusions can be drawn.

Second, the self-report nature of the study creates the potential for methodological limitations due to the risk of over-reporting socially desirable activity levels. Moreover, the self-report assessment of physical activity is typically inferior to more objective indicators of activity levels. Future research might use objective activity monitors or attendance at fitness programs to confirm activity behavior levels. A third limitation is the modest sample size. Although, 53 participants was considered to be sufficient for overall analyses, future studies should attempt to integrate larger samples that would allow for greater subgroup analyses. A fourth limitation is the potential of selection bias based on activity levels and current psychosocial status. That is, it might be argued that those adolescents who responded to the survey were more inclined to be physically active and were therefore more motivated to complete the survey. Moreover, not knowing the psychosocial status of the non-recruits is also a potential limitation as it is possible that those experiencing greater psychosocial distress would be less inclined to participate. A fifth limitation is the inability of the prime measure of psychosocial well-being (SDQ II) to consider the unique medical, physical, psychological, and social impact of the disease and needs of the adolescent following cancer diagnosis. Future research might incorporate the use of self-report measures designed to directly and systematically assess adolescent cancer patients' psychosocial well-being.

Summary

In summary, although not all adolescents experience symptoms of psychosocial disturbance which requires intensive therapeutic intervention, most assuredly *all* adolescents with cancer are in need of some form of supportive psychosocial services.

Research currently being conducted within the realm of exercise and cancer rehabilitation in the adult cancer population has shown to be particularly promising as exercise appears to be proving itself an effective tool in addressing not only the psychosocial needs, but also the, sometimes, more frequently reported physical symptoms (e.g., weight gain, fatigue, muscle atrophy) (Courneya & Friedenreich, 1997a). The present study provides preliminary evidence as to the potential role of LTPA in meeting the psychosocial needs of adolescents following cancer diagnosis. This line of research is innovative as never before has the use of physical activity been explored as a potential part of cancer rehabilitation within the adolescent population. Future research will be instrumental in assessing the potential inclusion of cost-effective physical activity programs in cancer rehabilitation settings and evaluating whether it helps adolescent cancer patients to normalize their lives as soon and completely as possible, which is the ultimate goal of cancer rehabilitation.

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Appendix A

Adolescent Cancer Facts

Cancer is a disease characterized by uncontrolled cell growth with the ability to invade and spread throughout the body. The exact cause of cancer in human beings is unknown, however, various agents or carcinogens have been identified as precursors of cancer. The symptoms of cancer vary significantly depending on the site of the malignancy or growth. Some important warning signals may include the following: (a) unusual bleeding or discharge, (b) a lump or thickening in any area, (c) a wound that does not heal, (d) a change in bowel or bladder habits, (d) hoarseness or persistent cough, (e) indigestion or difficulty in swallowing, (f) change in the size or appearance of a mole, and (g) an unexplained loss of weight. Diagnosis of cancer, like the symptoms, varies depending on the site. Diagnosis is verified by a number of methods, the most important being a biopsy. Other methods include the use of devices which permit visualization of hollow organs; computerized axial tomography (CAT); magnetic resonance imagery (MRI); mammography; ultrasound; cytology; and palpation for lumps. Treatment of cancer can include one or a combination of the following: surgery; chemotherapy; hormone therapy; radium; and radiotherapy (Pizzo & Poplack, 1997).

Leukemia is the most common malignancy found in the young, accounting for more than 25% of those cancers diagnosed in Canadian children and adolescents (Hutchcroft et al., 1996). Leukemia is a chronic or acute disease of unknown etiological factors characterized by unrestrained growth of leukocytes and their precursors and is classified according to the dominant cell type and the severity of the disease. Chronic

leukemias are rare in young people and will not be discussed here. Acute leukemias form two major groups: lymphoblastic and nonlymphoblastic.

Acute Lymphocytic Leukemia (ALL) accounts for 3/4 of the leukemias found in those under the age of 10 and accounts for ½ of those between 10 and 20 years of age (Hutchcroft et al., 1996). It is the leading cause of death in adolescents of both sexes. It is a disease of the blood forming organs (bone marrow) and is characterized by an abnormal proliferation and development of leukocytes and their precursors.

ALL is diagnosed on the basis of clinical symptomatology such as general malaise or tiredness, pallor, irritability, anorexia, bruising, bone pain, and liver/spleen/lymph node enlargement. In addition, laboratory findings of anaemia, thrombocytopenia, an increase or decrease in white blood cell counts coupled with a bone marrow aspirate confirm the diagnosis. The bone marrow aspirate will confirm the presence of lymphoblasts or stem/primitive cell (also known as leukemia blasts) predominance within the bone marrow. Inspection of the leukemia blasts allows for the classification of the cells into three categories (L1, L2, and L3), identified by a French-American-British team of experts - known as the "FAB" classification. A predominance of L1 cells is typically associated with a good prognosis, more than 10-25% of L2 cells requires aggressive treatment and L3 cell features are often associated with genetic changes and a poorer prognosis. Teenagers with ALL receive intensive chemotherapy for two or three years depending on their treatment protocol. Antileukemic therapy typically consists of three phases: Phase I - remission induction; Phase II - central nervous system prophylaxis; and Phase III - maintenance therapy with or without consolidation (Pizzo & Poplack, 1997).

During phase I, remission induction, the patient receives a combination of chemotherapeutic agents. Ninety five percent of children with ALL can receive remission induction with vincristine and prednisone alone, while other authors support the combination of several antileukemic agents. Since leukemic cells are capable of entering the central nervous system it is essential that prophylactic treatment be initiated as soon as hematolgic remission has been achieved. Thus, phase II consists of introducing chemotherapeutic agents into the intrathecal space via lumbar punctures. In addition, to chemotherapy some children may receive cranial irradiation. However, to avoid central nervous system toxicity and the resultant cognitive and intellectual deficits frequently noticed in the younger child, alternatives to cranial irradiation have been explored. Intrathecal chemotherapy in combination with systemic chemotherapy has provided comparable results to central nervous system irradiation. The last phase of therapy consists of a continuation of treatment in a less intensive form and normally lasts no longer than two years (Pizzo & Poplack, 1997). In Canada, approximately 75% of children/teens diagnosed with ALL were alive five years post diagnosis and many were considered cured.

Approximately 30% of children and teens with ALL will experience a relapse. If this happens the goal of therapy will be to attain a second remission. However, the likelihood of becoming disease free is less likely in those young people who relapse than those who do not. Bone marrow transplantation is often recommended for those who sustain a relapse (Hutchroft et al., 1996).

Acute non-lymphoblastic leukemia or acute myelogenous leukemia (AML) is far

less prevalent that ALL, accounting for only 15-20% of the leukemias in children and teens. AML is a malignant disease of the hemopoietic (blood forming) stem cells destined to be granulocytes, monocytes, red blood cells, or platelets (Hutchcroft et al., 1996).

Similar to ALL, AML is diagnosed on the basis of a medical history of fatigue, easy bruising, pallor, and a predisposition to infections. The leukemic cells have the ability to infiltrate all major organ systems of the body and therefore will produce related signs and symptoms, which may mimic other disease states. Hence, the key diagnostic procedure is that of blood and bone marrow aspirate analysis. Like ALL, AML cell types have been classified into FAB categories (seven), which are defined by the direction of cell differentiation and degree of maturation. The goal of treatment for the adolescent diagnosed with AML is profound marrow suppression. Hence, the treatment regime is very aggressive, requiring the administration of multiple drugs as frequently as the patient's system is able to tolerate. Combinations of cytosine arabinoside and anthracyclines are commonly used chemotherapeutic agents. They work by disrupting normal cell metabolism as well as the growth and spread of cancer cells. The use of these potentially lethal, multi-drug therapies, severely compromises the adolescent's immune system, and in an attempt to recover normal immune function some form of bone marrow transplantation may be indicated (Pizzo & Poplack, 1997). Where AML was once regarded as incurable, with intensive treatment regimes, including either allogeneic or autologous bone marrow transplant, five year survival rates in Canada are approximately 39% (Hutchcroft et al., 1996).

Central Nervous System (CNS) Tumors are tumors which are confined to the space of the skull or spinal cord and as they grow they place an increasing amount of pressure on and damage surrounding tissues. Along with lymphomas, CNS tumors are the second most common form of cancer in the young; accounting for 17%. Ninety percent of CNS tumors originate in the brain with the remaining 10% originating in the spinal cord. The most common type of CNS tumors include astrocytomas (50%), medulloblastomas (20%) and ependymomas (10%) (Hutchcroft et al., 1996).

Symptoms of CNS tumors vary depending on the site of the tumor. The most common symptoms of a brain tumor include headache, vomiting, and in some cases seizures and ataxia (unstable balance). Symptoms of spinal cord tumors include back pain, weakness, and poor bladder and bowel control. Diagnosis of a brain/spinal cord tumor is made by a CT (computed tomography) scan or MRI (magnetic resonance imagery) of the suspected area. The treatment of CNS tumor will vary depending on the location of the tumor and the age of the patient. Whenever possible, surgical removal of some or all of the tumor is performed. In most cases radiation plays a major role in the treatment of brain tumors, however, due to the risk of permanent damage to the brain, radiation therapy is usually delayed in those less than three years of age. Multi-agent chemotherapy has also improved over the years and has significantly increased disease free survival for some young people with medulloblastoma or astrocytoma.

The long term prognosis for CNS tumors depends on a number of factors including age of diagnosis, tumor type and location, effectiveness of initial treatment (e.g., removal), and the presence or absence of tumor spread. In Canada, the five year survival rate for

children/teens diagnosed with a CNS tumor between 1985 and 1988 was 60% (Hutchcroft et al., 1996).

Lymphomas, along with CNS tumors, are the second most common form of cancers in the young. Like CNS tumors it accounts for 17% of cancers in those under 19 years of age and is the most common form of cancer in those 15 to 19 years. Lymphoma is a malignant tumor of the lymphoid tissue, and includes two main types, Hodgkin's disease and non-Hodgkins lymphoma.

Hodgkins lymphoma typically first presents itself as an enlargement of the lymph nodes. Other symptoms may include fever, night sweats, weight loss, itchiness and/or cough. Diagnosis of Hodgkins lymphoma is confirmed by the biopsy of an enlarged lymph node. Treatment normally consists of radiation and chemotherapy. Ninety percent of children/teens diagnosed with Hodgkins lymphoma were alive five years post diagnosis between 1985 and 1988 (Hutchcroft et al., 1996).

Non-Hodgkins lymphoma arises within the lymph tissue of the chest or abdomen and has a tendency to spread to the bone marrow and CNS. Enlargement of the nodes within the chest and abdomen may cause difficulties in breathing and abdominal pain, with or without vomiting. Childhood non-Hodgkins lymphoma presents and is treated much differently than its adult counterpart. Treatment consists of multi-agent and intrathecal chemotherapy. Approximately 70% of children/teens diagnosed with non-Hodgkins lymphoma were alive five years post diagnosis between 1985 and 1988 (Hutchcroft et al., 1996).

Complications of Treatment

Due to the immunosuppressive nature of both the disease and the intensive treatment (e.g., chemotherapy) the child is at an increased susceptibility for infection, haemorrhage, and/or anaemia. Many children will require intravenous antibiotics and a transfusion of platelets and red blood cells to overcome such complications. In respect to bone marrow depression, the adolescent typically tolerates chemotherapy better than the younger child. However, the adolescent does seem to have an increased incidence of arachnoiditis due to intrathecal therapy, polyneuropathy due to vincristine and there may be an increased risk of gonadal dysfunction (Van Der Does-Van Den Berg, De Vaan, Van Weerden, Halen, Van Weel-Sipman, & Veerman, 1995; Hovi et al., 1993). Further complications are related to the direct effects of the chemotherapeutic agents which include hair loss, nausea, vomiting, fatigue, bone pain, mouth sores, changes in appetite, gastrointestinal disturbances, alterations in mood (Hutchcroft et al., 1996), disturbances in pulmonary function (Jenny et al., 1995) and cardiac toxicity (Steinhertz, Tan, Heller, & Murphy, 1991). Due to the aggressive nature of treatment for those adolescents diagnosed with some forms of cancer (i.e. AML) these side effects may be greatly pronounced.

Children/adolescents receiving radiation therapy may present with complaints of headache, loss of appetite, fatigue, reductions in muscle mass, bone fragility, redness of the skin over the treatment site, and depression lasting for 1-2 weeks (Hutchroft et al., 1996; Koocher, 1981). Those children receiving cranial irradiation, specifically to the hypothalamic-pituitary axis (HPA), have shown abnormalities in physical stature

(Talvensarri, Knip, Lanning, & Lanning, 1996; Van Der Does-Van Berg et al., 1995), growth hormone secretion, and early menarche (Talvensaari, et al., 1996; Hovi et al., 1993). These complications are less common in the older adolescent. Furthermore, those children who have undergone antineoplastic treatment tend also to be at a greater risk of obesity and therefore at a greater risk of long term morbidity and mortality at an earlier age (Turner-Gomes, et al., 1996; Talvensaari, et al., 1996; Van Der Does-Van Den Berg et al., 1995).

APPENDIX B

Psychosocial Impact of Cancer Diagnosis and Treatment

Adolescence is a time inherent with both psychological and physiological changes and can be a stressful period of life, even in the best of circumstances. No longer is adolescence simply considered a transitional period from childhood to adulthood, rather it is regarded as a critical phase of the life course (Offer & Boxer, 1991). It is marked by a number of physiological, cognitive, and social changes and a prevalent need for interpersonal intimacy. It is the successful handling of a set of developmental tasks (i.e., puberty, need for autonomy, intimate relations) which will equip the adolescent with the necessary knowledge and skills required for adulthood. One would be hard pressed to think of any other time when one's physical appearance, athletic performance, and peer acceptance is more highly valued than in their teen years (Koocher & O'Malley, 1981). For the adolescent with cancer these natural physical, psychological, and social changes are compounded by the cancer experience. For in contrast to the younger child who cannot yet fully comprehend the full ramifications of the disease, the adolescent is knowledgeable enough to recognize that something is seriously wrong, yet may not have developed the skills of an older adult to cope with such information. The impact of diagnosis on the successful completion of normal, age-appropriate, developmental tasks may be the reason for many of the psychosocial disturbances experienced by these adolescents. Although some have suggested that adolescents can be very resourceful and cope very well (Kellerman et al., 1980), many display an increased tendency towards problems with peer relationships (e.g., Pendley et al., 1997), depression (e.g., Kashani &

Hakami, 1982), altered perceptions of self and body image (e.g., Puukko et al., 1997) , and a move towards an external locus of control (e.g., Jamison et al., 1986). Albeit there seems to be no clear consensus as to whether or not theses adolescents will experience long-term psychosocial problems, what is clear is that these adolescents are at a significantly greater risk for increased psychological distress than their healthy peers.

Self-Esteem and Self-Perception. Cancer and its associated treatment can be perceived as a powerful stressor. More specifically, bodily changes and a disruption in normal activities can be associated with a decreased sense of self-worth. Jamison et al., (1986) conducted a retrospective study to investigate the impact of cancer on self-image on those adolescents who did not demonstrate any physical disabilities. Using the Offer Self-Image Questionnaire for Adolescents (OSIQ), Jamison et al., (1986) found no significant difference between healthy and ill adolescents. However, significance was approached on several of the sub-scales, including vocational and educational goals for both males and females, sexual attitudes for females, and body image for males. Jamison et al., (1986) concluded that poor self-concept is not necessarily a by-product of the cancer experience and that adolescents develop strong coping mechanisms to deal with any disruptions. Likewise, Kellerman et al., (1980) found no differences between the self-esteem of adolescent cancer patients and healthy controls. Although, they did note that, as a whole, females reported lower self-esteem as compared to males. What is interesting, is that Kellerman et al. (1980) noted that those adolescents with increased self-esteem showed decreased anxiety and increased control over their health. In contrast, several authors have reported that poor self-esteem was one of the residual

psychosocial sequelae of childhood cancer (Smith, Ostroff, Tan, & Lesko, 1991; Koocher & O'Malley, 1981; Koocher, O'Malley, & Gogan,1980).

In an attempt to assess the impact of cancer on self-perception, Smith et al., (1991) interviewed 58 adolescent cancer survivors. The study found that an overwhelming majority (83%) of the survivors reported that the cancer affected the way they perceived themselves. Moreover, Smith et al., (1991) found that alterations in self-perception were related to changes in family relationships (i.e., increased family involvement - conflict between parental overprotection and nurturance), peer relationships and illness concerns (i.e., disease recurrence). Smith et al., (1991) concluded that cancer does have a profound impact on the adolescent's self-perception, however, this impact is highly variable, having both positive and negative influences. For instance, those adolescents who perceive a comfortable balance between family involvement and opportunities for autonomous development are capable of positive self-perception. In contrast, those who perceive the family relationship as becoming intrusive or overprotective may feel more restricted than their peers in developing normal autonomy. If this restriction is viewed by the adolescent as being a result of an inherent weakness or vulnerability their self-perception may be negatively altered. In addition, Smith et al., (1991) found that rather than feeling rejected by their peers, these adolescents simply find themselves "different" as a result of their illness. A major finding of this study was the relationship between self-perception and illness concerns. Smith et al., (1991) noted that 90% of the adolescents reported worrying about disease recurrence and that the degree of worry was significantly associated with an alteration in

self-perception.

Body Image. Standard therapies for cancer treatment often involve invasive procedures which may require prolonged hospitalization and can result in changes in physical appearance such as hair loss, weight gain/loss, spinal curvatures, and amputations. Most healthy adolescents experience considerable anxiety over the changes in their physical appearance and the development of secondary sexual characteristics associated with puberty. These normal concerns may be magnified by the potential physical side effects of an illness or its treatment.

Body image refers to the way that one perceives one's physical body and its functions and is a part of the entire self-image. In an attempt to explore the impact of cancer diagnosis on body image, Pendley et al., (1997) examined body image in 21 adolescents who had completed cancer treatment. Pendley et al., (1997) found no significant differences between survivors and healthy peers on four objective or self-perceived ratings of attractiveness. However, they did find that as time since the termination of treatment increased, more negative body image perceptions were reported.

Puukko et al., (1997) compared the results of a self-report measure (OSIQ) and a face-to-face interview in an attempt to assess the impact of cancer diagnosis on body image. They found that the self-report measure yielded no differences in the perceived body image of leukemia survivors and age-matched controls. The interview, however, revealed significantly lower body images in survivors. Such results are consistent with the findings of Cappelli, McGrath, Heick, MacDonald, Feldman, and Rowe (1989) who found no differences between healthy controls and adolescents with chronic illness in

standardized, self-report measures of body image, whereas semi-structured interviews revealed important differences. Puukko et al., (1997) supported these findings of the negative impact of cancer diagnosis on body image as they concluded that the body image of female leukemia survivors was inferior to those of control subjects.

Depression. Worchel, Nolan and Willson (1988) found that ill children tended to report less depression that the normal population and when asked to assess their disease status, 96% rated themselves as getting better. This rating was inconsistent with physician ratings in which only 43% were evaluated as getting better. Furthermore, although parental and nursing ratings were significantly correlated, no significant correlation existed with the children's self-reports of depression. Worchel et al., (1988) concluded that the children may use denial as a coping mechanism as seen in their under reporting of symptoms.

Locus of Control or an individual's attitudes toward their ability to control their own destiny, may also be affected by cancer diagnosis. The physical side effects of cancer and its treatment may make it necessary for the adolescent to depend on others for care. That is, medical treatment and hospitalization inevitably requires a shift in control from the adolescent to medical staff and can result in an increased emotional dependence on the parents.

Kellerman et al., (1980) compared locus of control measures of 349 physically active and healthy adolescents with 168 adolescents diagnosed with various chronic illnesses. They found a significant difference between the ill and healthy groups on the measure of locus of control, with the ill adolescents demonstrating a greater external

locus of control. However, these results were not consistent across all diseases (i.e., non-significant findings with cystic fibrosis and diabetes), suggesting that perceived locus of control differs from diagnosis to diagnosis. Kellerman et al., (1980) noted that those who showed an internal locus of control (i.e., cystic fibrosis and diabetes) felt capable of exerting some degree of control over their disease through diet and self-administered medications. This is not the case, however, for those adolescents diagnosed with cancer, as their treatment regimes are much more rigid and medically controlled. Jamison et al., (1986) also found that cancer patients demonstrated a decreased internal locus of control and tended to adopt an external orientation.

Peer Relationships and Social Adjustment. Developmental theory suggests that adolescence is a period of time in which the peer group is of the utmost importance. Orr (1984) noted that adolescents cited peer relations and isolation as major concerns. A psychosocial overview by Carr-Gregg and White (1987) noted that over 70% of adolescents with cancer experienced significant problems with friends (i.e., loss of friends, being treated as if one was contagious) as a result of their diagnosis. Likewise, a review article by Ettinger and Heiney (1993) found that adolescents were concerned about being with their peers. Many felt ignored, ridiculed, or that they were being treated differently (i.e., overprotected) and as such these adolescents are more likely to show deficits in peer related activities and social competence.

A recent study conducted by Pendly et al., (1997) found that the most striking difference between cancer survivors and their healthy peers was in peer activities. That is, cancer survivors reported participating in less than half the number of activities than

their peers. Although they did note that these adolescents did not report feeling lonely or more isolated at the time of diagnosis, loneliness and social anxiety increased significantly with time since diagnosis. This suggests that as the medical necessity for their isolation dwindles the adolescent's sense of loneliness and anxiety increases. Similarly, Spirito, Stark, Cobiella, Drigan, Androkites, and Hewett (1990) and Noll, Bukowski, Rogosch, LeRoy, and Kulkarni (1990) found that cancer survivors spent more time alone than others their age, even though they did not choose or wish to be alone.

Mulhern, Wasserman, Friedman, and Fairclough (1989) investigated the effects of cancer diagnosis on social competence and behavioral adjustment of a large sample of children. They found that long term survivors were three to four times more likely to show deficits in social competence and behavioral abnormalities compared to healthy peers. Factors that played a significant role in these findings included physical and functional limitations, older age at follow-up, cranial irradiation for those with leukemia, and residence in a single parent home. Mulhern et al., (1989) concluded that because late psychological effects may not become apparent for many years following diagnosis, long term follow-up and screening should be provided.

Family Relationships. In recognition of the normal adolescent process of progressively seeking more autonomy from his/her parents, teenagers diagnosed with cancer may be faced with many emotional ambiguities. On the one hand, they are in need of finding their own individuality, but on the other hand the family is often the chief source of social support. Several authors have noted the problem of parental overprotectiveness and how such a problem may interfere with normal adolescent

development (Carr-Gregg & White, 1987; Ettinger & Heiney, 1993).

Concerns for the Future. Few diseases cause greater feelings of anxiety and apprehension than cancer. In fact, cancer is still thought by many to be a terminal disease. This threat to the adolescents' survival, be it real or perceived, may play a significant role in their emotional and psychosocial development. If the treatment fails to provide or maintain a remission, this threat becomes much more real. However, in light of recent medical advances the number of adolescent cancer survivors is growing and a whole new spectrum of psychosocial sequelae is inevitably encountered (Lansky, List, & Ritter-Steer, 1986). The adolescent will be forced to deal with the delayed effects of the toxic drugs and intensive treatments used to save their lives as well as the real possibility of a second malignancy, or recurrence of the primary malignancy (Carr-Gregg & White, 1987).

Mitchell (1986) notes that adolescents visualize and anticipate their future and that this assessment of their future is one of the most important factors in identity formation. "The more optimistic the future, the greater is the ability to cope with adversity in the present; the more negatively one views the future, the more overpowering is present pain" (p. 25). Mitchell (1986) describes the future as an "essential parcel" (p. 26) in the adolescent package; that is, they need to be convinced that the future will not deny them of intimacy, esteem, productive work, and love.

Appendix C

Studies Investigating the Psychosocial Well-Being in Children and Adolescents with Cancer and Other Life Threatening Illness

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Puukko, L., Hirovonen, M., Aalberg, V., Hovi, L., Rautonen, & Siimes, M. (1997).	28 female leukemia survivors (≥ 14 years) in CCR & off therapy for ≥ 1 year. 34 age-matched, healthy controls.	Quasi-Experimental.	Body image was assessed by: (a) Offer Self-Image Questionnaire; and (b) a face-to-face interview conducted by an adolescent psychiatrist Questions included: 1. How do you find your own physical appearance? 2. What are positive features of your own appearance? 3. What are negative features of your own appearance? Scored in three categories: 1 - Appropriate 2 - Impaired 3 - Diffuse Total Scores: 3-5 Appropriate body image 6-7 Impaired body image 8-9 Diffuse body image	Self-reports questionnaire noted no differences in perceived body image. Interview noted significant differences in perceived body image (P=.001). 28% of survivors were rated as having an appropriate body image compared to 90% of the healthy controls. 36% of survivors were rated as having a diffuse body image as compared to 3% of the healthy controls.
Puukko, M., Sammallahti, P., Siimes, M., & Aalberg, V. (1997).	42 female survivors of acute leukemia and 69 age-matched controls.	Retrospective.	Three distinct evaluations of the subject's body image: (a) Subject's self assessment; (b) evaluation by a psychiatrist; and (c) the Rorschach test.	The body image of female survivors of leukemia were inferior to those of the age-matched controls. Self Assessment: body image of survivors more often classified as impaired vs controls (57% vs 27%), & less often classified as appropriate vs controls (16% vs 70%). Survivors had an inferior ability to perceive their own physical appearance. Findings were congruent across all 3 tests.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Pendley, J.S., Dahlquist, L.M., & Dreyer, Z. (1997).	9 female & 12 male cancer survivors (11-24 years). Diagnosis included: leukemia (8), lymphoma (9), & other solid tumors. Mean time since treatment completion - 17 months.	Retrospective.	Body Image Assessment Measures: (a) Self-Image Questionnaire for Young Adolescents (SIQYA); (b) Body Cathexis Scale (BSC); (c) Self-Report Likert Ratings of Body Image; (d) Self-Perception Profile for Adolescents (SPPA); (e) Body Image Avoidant Questionnaire (BAIQ); (f) Situational Inventory of Body Image Distress (SIBID); and (g) Objective Ratings of Attractiveness. Measures of Psychosocial Adjustment: (a) Peer Activities; (b) Loneliness Questionnaire; (c) Social Anxiety Scale for Children-Revised (SASC-R); (d) Self-Perception Profile for Adolescents (SPPA); and (e) School Attendance.	Group Differences: Body Image: no significant differences were found between survivors & healthy peers on 4 objective or self-perceived ratings of attractiveness. Social Adjustment: showed that survivor participated in fewer peer activities. No significant differences noted in school absenteeism or measures of loneliness & social anxiety. Strong correlations noted between body image & social adjustment. Loneliness & social anxiety correlate with time since treatment termination, that is, survivors become more lonely and anxious over time.
Stuber, M., Christakisi, D., Houskamp, B., & Kazak, A. (1996).	64 leukemia survivors (7 - 19 years) and their parents (63 mothers & 42 fathers).	Retrospective.	Both the patients & their parents completed a 20-item self-report of Posttraumatic Stress Disorder Reaction Index. The survivors & parents were asked to report symptoms in response to the survivor's cancer and treatment. Scored of 0 - 6 indicated no PTSD; 7 - 10 mild; 11 - 13 moderate; and > 13 severe PTSD symptoms.	12.5% of survivors, 39.7% & 33.3% of fathers fell within the severe range of PTSD. Specific symptoms relayed by cancer pts included: bad dreams (59.4%), feeling afraid or upset when they think about cancer (51.6%), feeling alone inside (54.7%), & nervousness (51.6%). (77.8%), intrusive thoughts of cancer (76.2%), distress at reminders (76.2%), and fear of relapse (76.2%).

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Stuber, M.L. et al. (1996) cont				Fathers reported being afraid or upset when thinking of cancer (80.9%), tension when thinking of what happened (87.8%), and intrusive thoughts about cancer (69.0%). Mothers reported being afraid or upset tension when thinking of cancer (79.4%), re-experiencing of disturbing scenes (77.8%), intrusive thoughts of cancer (76.2%), and fear of relapse (76.2%).
Smith, K., Ostroff, J., Tan, C., & Lesko, L. (1991).	58 adolescent survivors of hematologic malignancies between 12 - 19 years.	Cross-sectional.	Semi-structured interview with both forced choice and open ended format. Social Cognition Measure - Cancer. Medical Late Effects Checklist - Physician Rated	As a whole, 83% reported that the cancer experience affected the way that they perceived themselves. 50% rated the effect of cancer on self-perception to be moderate.
Spirito, A., Stark, L., Cobiella, C., Drigan, R., Androkites, & Hewett, K. (1990)	56 cancer survivors diagnosed between 2 - 5 years & 52 age-matched controls.	Retrospective.	Child Measures: (a) Self-Perception Profile for Children; and (b) Social Skills Questionnaire. Teacher Measures: (a) Taxonomy of Problem Situations (TOPS); and (b) Deasy-Spinetta Behavioral Questionnaire (DSBQ). Parent Measures: (a) Taxonomy of Problem Situations (TOPS - parent); and (b) Parent Interview Questions.	Child Self-Report: 22% of survivors reported that they spend less time alone than others their age, 47% said more than others, & 31% said the same as others. Compared to 20%, 22% and 58%, respectively, in controls. Teachers Report: Noted that survivors were in general, more willing to attend school; also rated lower than controls in their apprehension of school, restlessness, getting teased & arguing. Parent Report: Noted that survivors were significantly less active than controls. Survivors more likely to be retained in school (30%) as compared to controls (9%). Cancer pts were more likely to have received individual/group counselling.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Greenberg, H.S., Kazak, A.E., & Meadows, A.T. (1989).	138 survivors (8-16yrs) (& their mothers) in CCR for >5yrs & off therapy for >2yrs. 92 age, sex, & race matched healthy controls & their mothers.	Retrospective.	Piers-Harris Self-Concept Scale. Nowicki-Strickland LOC Scale for Children. Children's Depression Inventory. Family Environment Scale. Derogatis Stress Profile. Questionniare assessing: (a) Whether & in whom they confided having had cancer; & (b) any present health concerns.	Survivors of childhood cancer had significantly poorer self-concepts. No significant difference between survivors & comparison group with respect to depression - denial?? Survivors had a significantly more external LOC.
Mulhern, R., Wasserman, A., Friedman, A., & Fairclough, D. (1989).	118 childhood cancer survivors (≤15 years) in CCR for ≥5 years & off therapy for ≥ 2 years.	Retrospective.	Child Behavior Checklist (CBC) completed by the patient's parents.	Most frequent chronic problems were: scars, visual impairments, learning problems, & obesity (one or more of were noted in 83% of subjects). Noted poor school performance & ↑ somatic complaints 64% of the sample displayed 1 or more abnormalities on the CBC (which is significantly more frequent than general population P=.005) An age of ≥12 yrs at follow-up was associated with ↑ school related problems & somatic complaints. Cranial irradiation for leukemia noted a 3X ↑ in school related problems.
Fritz, G., Williams, J., Amylon, M. (1988).	52 survivors of childhood cancer between the ages of 7 and 24 years and their parents.	Retrospective.	Structured interview with the child to assess: history prior to illness, the illness & therapy course, & a review of the child's life since treatment ended. Structured interview with the parents covered the same information. In addition the interview explored the personal, social, & occupational changes in their own lives consequent to their child's cancer. In addition to the interview the child and parents completed several self-reports measures, incl:	21% of patients showed minor problems in school. 47% saw themselves as moderately physically active; 25% as sedentary; & 25% as more active than avg. for their age. 28% felt they had become less active since diagnosis; 20% more active; and 52% believed that there was no change.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Fritz et al., (1988). cont'd			Four illness related antecedent variables: (a) nature of the diagnostic process; (b) prognostic characteristics; (c) difficulty of treatment course; and (d) residual physical impairment.	Social/peer interaction index noted 23% were less socially active.
			Three psychosocial related antecedent variables: (a) directness of communication; (b) peer support and (c) discouragement. Six outcome variables: (a) school functioning; (b) activity index; (c) social/ peer interaction; (d) current openness; (e) Children's Depression Rating Scale (CDRS); and (f) global adjustment rating.	80% rated as free of depressive symptomatology; 14% rated as being questionable; 6% rated as significantly depressed. Global ratings of function: 25% rated as excellent; 36% as good; 26% as average; 6% as marginal; and 8% as poor. ↑ physical impairment associated with ↑ depression & ↓ global adjustment. ↑ age at diagnosis associated with ↑ depression scores.
Worchel, F., Nolan, B., Willson, V., Purser, J., Copeland, D., & Pfefferbaum, B. (1988).	76 pediatric cancer pts. 42 pediatric psychiatric pts. 304 normal school children.	Retrospective.	Children's Depression Index (CDI). The Achenbach Child Behavior Checklist (CBCL). The Nurse's Rating Form. Severity of Disease Rating (Stable, getting better/worse).	Psychiatric inpatients showed a sign. ↑ in CDI scores (↑ depression) than ill or control groups. Also a trend for normals to report ↑ depression as compared to the ill patients. Severity of Disease Rating: 96% of ill patients rated themselves as getting better; while physicians rated only 43% of ill patients as getting better. Noted that parental ratings of ill patients depression significantly ↑ as compared to patient self-reports. For cancer pts only older adolescents reported less depression than younger children.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Lansky, S.B., et al. (1986).	39 adolescents diagnosed with cancer between the ages of 10 & 18 years. Pts were at least ≥ 5 years post diagnosis.	Retrospective. Pilot study.	Each subject was interviewed to determine family demographics, past & present medical problems, academic & career achievements, disease impact, in 28%. issues related to separation, & overall psychological assessment.	Noted disruptions in school attendance in 87% of patients & academic problems 46% indicated that their future academic plans had changed & 38% suggested a shift in career goals due to cancer. Over ½ of the patients recalled changes in extracurricular activities & disruptions in peer relationships. 15% reported it taking ~2 years to re-establish previous activities. Data suggests that there may be an ↑ average incidence of depression in this group.
Jamison, R.N., Lewis, S., & Burish, T.G. (1986)	31 patients between 12-18 years, diagnosed with ALL (15), Hodgkins (8), Rhabdomyosarcoma (2), AML (2), Non-hodgkins lymphoma (1), Ewing's sarcoma (1), malignant lymphoma (1), & brain tumor (1). 203 teenage controls.	Retrospective.	Offer Self Image Questionnaire for Adolescents (OSIQ). Multidimensional Health Locus of Control (MHLC). Perception of Illness. Knowledge of Cancer.	No significant differences between cancer & healthy adolescents on self-image. Cancer patients showed ↓ internal locus of control and ↑ scores on external scales, powerful others & chance. Noted significant relationship between knowledge of cancer & self-image.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Kashani, J. & Hakami, N. (1982).	35 children & adolescents (25 males & 10 females), ages ranging from 6 to 17 years. Time since diagnosis: 1 mo. to 10 years.	Prospective.	A child psychiatrist evaluated all patients & their parents in a semi-structured interview. Criteria for a diagnosis of depression was based on DSM-III.	17% of patients showed evidence of depression. This result is significantly ↑ over frequency of depression normally seen in children (1.9%) and adolescents (4%) within the normal population. Noted that older patients tended to be more depressed. Separation anxiety noted in 34% of children (41% of those were ≥ 14 yrs). Emotions such as being frightened, scared, or fearful noted in 37% of the patient population. Anger & irritability was noted in 48% of the children. 42% of patients exhibited signs of withdrawal, refusing to talk with others & remaining quiet.
Schuler, D., Polcz, A., Revesz, T., Koos, R., Bakos, M., & Gal, N. (1981).	48 children with acute leukemia in CCR for 3 ½ years or more.	Retrospective.	Wechsler Intelligence Scale for Children (WISC). World Test (to assess fear, depressive tendencies, & narrowing personality). Psychological care included: (a) psychotherapy of children & parents; (b) social care; (c) creative activities; (d) music therapy; and (e) education.	Noted small, but significant ↓in IQ of children were under 6 yrs at time of diagnosis. Normal intelligence was observed in remaining patients. Several emotions problems were noted in the patients incl.: fear, negative projections, ↓interest & motivation, & a tendency for depression. Those receiving psychological care showed significant ↓ in frequency & severity of emotional problems.

Study/Year	Sample Size	Design	Psychosocial Variable/Measure	Results
Kellerman, J., Zeltzer, L., Ellenberg, L., Dash, J., & Rigler, D. (1980)	517 adolescents - 349 physically active and healthy; 168 adolescents from the following disease groups: oncology, diabetes, cardiology, cystic fibrosis, nephrology, & rheumatology.	Retrospective.	Self Administered Questionnaires: State - Trait Anxiety Inventory. Rosenberg Scale of Self Esteem. Health Locus of Control Scale.	No differences noted between healthy & ill adolescents on trait anxiety or self esteem or between various ill groups. Females of both groups reported lower self-esteem than males. Significant difference noted between ill & healthy adolescents for locus of control, with ill adolescents showing ↑ external locus of control (true for pts with oncologic, cardiologic, renal, & rheumatologic disorders). Noted that adolescents with ↑ self-esteem showed ↓anxiety and ↑ control over their health. Prognosis associated with trait anxiety - "stable" pts showed ↓ trait anxiety in comparison to those with ratings of "improvement", "deterioration", or "uncertainty".

Appendix D

Psychosocial Interventions.

In light of the recent improvements in the treatment of childhood cancers, the likelihood of long term survival is increasing at a remarkable rate. However, with prolonged survival comes a whole new set of concerns. No longer is the focus on dealing with issues of death and grieving, instead there has been a shift to a focus on ways of managing the long term adjustment to chronic illness and dealing with the potential of recurrence or second malignancy (Jamison et al., 1986; Carr-Gregg & White, 1987). In an attempt to address the psychosocial consequences of cancer diagnosis and treatment, a range of psychological interventions are being utilized. These include: cognitive-behavioral therapies (e.g., relaxation, biofeedback, meditation, behavior modification, hypnotherapy, desensitization), informational and educational strategies (e.g., medical, procedural), individual counselling or psychotherapy, social support (e.g., family or other patients), and other alternative treatments (e.g., music therapy) (Meyer & Mark, 1995; Fawzy, Fawzy, Arndt, & Pasnau, 1995).

More specific to the adolescent population, the central aim of psychosocial interventions is to minimize the impact of cancer diagnosis on the normal developmental processes. This is accomplished by maximizing the teen's sense of control, maintaining open and honest relationships, respecting the teen's need for privacy, encouraging the resumption of normal activities, family support, making available a multidisciplinary approach (Carr-Gregg & White, 1988), and perhaps most importantly being aware of the needs specific to the adolescent.

Other less formal interventions which are proving beneficial are summer camp experiences. The Kids Cancer Camps of Alberta and Camp Dost are just two examples of such camps which have been designed to cater to the young cancer population. The camps provide a cost-free program for children with cancer and their siblings which affords them the opportunity to participate in a variety of fun activities, develop new skills, improve self-concept (Benson, 1987), self-esteem, provide opportunities for a sense of self mastery and efficacy in peer relationships and to develop a greater sence of independence from their all to often overprotective parents (Wandzura & Caccavo, 1998; Swensen, 1988; Smith, Gotlieb, Gurwitch, & Blotcky, 1987; Hvizdala, Miale, Barnard, 1978). Overall it was concluded that the changes that these children experienced were not a result of a formal intervention, but rather a natural consequence of being in a fun and rewarding environment.

Appendix E

Relationship Between Exercise and Psychosocial and Physiological Well-Being

Healthy Adolescent Population

Psychosocial. A great deal of research has examined the relationship between physical activity and mental health benefits within the adult population. The literature has consistently concluded that physical activity and mental health demonstrate a positive relationship. That is, the higher the level of physical fitness, the higher the level of mental health (Morgan & O'Connor, 1988). A review of the literature was conducted to examine the impact of physical exercise on adolescent psychological well-being and an overview is provided (refer to Appendix F for study summary tables and a more detailed review of the authors, sample, design, psychosocial measures, and results for each study).

Depression in adolescents, as defined by the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV) (American Psychiatric Association, 1994), is characterised by five or more of the following (at least one of the symptoms must be either depressed mood or loss of interest in pleasure): irritable mood; markedly diminished interest or pleasure in all, or almost all, activities; significant weight loss; sleep disturbances; psychomotor agitation or retardation; loss of energy; feelings of worthlessness or excessive or inappropriate guilt, diminished ability to think or indecisiveness, and/or recurrent thoughts of death. Research studying the prevalence of depression in adolescents have noted that approximately 8% will experience depressive disorders (Kashani, Carlson, Beck, Hoeper, Corcoran, McAllister, Fallahi, Rosenberg, & Reid, 1987).

Brollier, Hamrick & Jacobson (1994) looked at the relationship between exercise and depressive symptomatology in four male, long-term, adolescent inpatients. All had major depression as a primary diagnosis, and none had responded well to out-patient interventions or other short-term hospitalizations. The exercise program consisted of brisk walking and running and met three times a week for 65 days. The Beck Depression Inventory was used on five separate occasions to assess depression. Overall, Brollier et al. (1994) found a general decrease in depression scores for all subjects. However, due to the small sample size, there is a need to replicate these results. Brown, Welsh, Labbe, Vitulli, & Kulkarni (1992) investigated the effects of a three day per week running/aerobic program over a 9 week period as a adjunctive treatment in an institutionalized adolescent population. Measures on the Beck Depression Inventory showed a decrease in depression for treatment subjects after 4 ½ weeks. However, this change was only noted in girls. What is noticeable about this finding is that changes for the treated group were noted by 4 ½ weeks and prior to improvements in aerobic fitness. Changes between the treatment and control groups had disappeared by the 4 week follow-up. Suggesting that such changes induced by aerobic exercise are transitory. However, Brown et al. (1992) speculated that a continuation beyond the original 9 week program would stimulate further benefits. Brown & Lawton (1986) investigated the impact of physical exercise on depressed mood in 220 adolescent girls. Using a retrospective, self-report format, Brown & Lawton (1986) found a significant negative relationship ($r = -.25$, $p < .001$) between exercise and depression scores. In an attempt to address a more holistic approach to nursing care, Finocchiaro and Schmitz (1984) conducted a pilot study to

assess a treatment modality which would address man as a bio-psycho-social being. They concluded that exercise may decrease depression in the emotionally disturbed adolescent. Finally, MacMahon & Gross (1988) investigated the relationship between participation in an aerobic exercise program and improvements in the mood of juvenile delinquents. In an attempt to determine whether psychological benefits are related to the intensity and duration of exercise, are independent of physiological changes, or whether they are associated with the social and recreational settings in which the exercise program was carried out, they conducted a prospective comparison of two exercise programs (aerobic versus comparison) with varying physical intensity in a population of incarcerated adolescent males. Participants in the aerobic program experienced 40 minutes of sustained exercise (i.e., long distance running, vigorous basketball) causing a sustained heart rate of above 160 beats per minute three times per week. The comparative exercise program was similar in duration, but it consisted of activities which were designed to avoid sustained elevations in heart rate. Measurements carried out after three months of participation in the exercise program demonstrated significantly greater improvements in mood and physical fitness in those subjects who participated in the aerobic exercise program. These data suggest that more psychological benefits are associated with more vigorous physical activity. However, data presented in a correlation matrix implied that psychological benefit of aerobic exercise was independent of cardiovascular fitness.

Of the studies reviewed, all found a positive relationship between exercise and depressed mood. In a meta-analysis of adults and children (North, McCullagh, & Z.V., 1990) exercise was found to be a better antidepressant than relaxation or other enjoyable

activities. North et al. (1990) also noted that those participants requiring the most medical/psychological care showed the largest decreases in depression.

Emotional Well-Being. Although there is no reason to consider adolescence as inherently stressful, given the number of physiological and psychosocial challenges that adolescents are required to confront, it may be plausible to suggest that they are vulnerable to the effects of stressful life events (Brown & Lawton, 1986; Brown & Seigel, 1988). In an attempt to investigate the affects of life events on health, Brown & Siegal (1988) utilized a prospective design to assess the ability of physical exercise to buffer stress-induced deteriorations in physical health. In a sample of 212 females, Brown & Siegal (1988) found that stress scores were inversely related to health at both initial and final assessment. That is, the negative impact of stressful life events on health declined as exercise levels increased. These results complemented the findings of an earlier cross-sectional study of life stress and well-being in adolescence (Brown & Lawton, 1986). They found that the negative impact of life events were significantly lower in those who exercised frequently in comparison to those who rarely exercised. That is, regular exercisers evidenced only minor disturbances in physical health under conditions of high stress, whereas those who reported exercising infrequently reported higher levels of physical illness. In an attempt to address some of the methodological limitations of the previous studies, Norris, Carroll & Cochrane (1992), re-examined the effects of exercise training on psychological well-being in a heterogeneous (with respect to socio-economic status) group of both male and female adolescents. Part I of the study was retrospective in design and used self-report measures. The present study revealed a significant

relationship between Life Events and Seriousness of Illness, which demonstrates an association with adolescent perception of life events and somatic health. In light of the limitations of the retrospective nature of this design, the findings of part I of this study (Norris et al., 1992) suggest that adolescents who report an increased frequency of exercise also report lower levels of perceived stress. Further expanding the scope of this study, Norris et al. (1992) conducted an intervention study to assess the impact of various intensities of exercise on psychological well-being. Adolescents were assigned to either high or moderate intensity aerobic exercise, flexibility training, or a control group. The training groups met twice a week for 10 weeks. Following the 10 week intervention, subjects undergoing high intensity exercise displayed the anticipated increases in cardiovascular endurance as evidenced by improved resting heart rate and improved recovery time following the step test. None of the other groups demonstrated such improvements in regards to aerobic fitness. Final analysis revealed that the high intensity group reported significantly less stress than subjects in the remaining three groups. They also reported less anxiety than the moderately active group. Finally, the high intensity group demonstrated a weakened relationship between perceived stress and anxiety and depression following the intervention. Brown et al. (1992) assessed the effects of a 9 week, 3 day per week, running/aerobic exercise program on adolescent anxiety. They noted by midevaluation, 4 ½ weeks, a decrease in anxiety was noted in treated girls, and by 9 weeks a decrease was noted in both males and females. As with the findings of improved depression measures, changes in anxiety disappeared by the 4 week follow-up period. Suggesting that any beneficial effects of exercise are transitory. The above data

does offer support that in an adolescent population, aerobic exercise, is associated with reductions in stress and anxiety. However, as shown by Norris et al. (1992) these benefits may be linked to a corresponding increase in aerobic fitness.

Self-Esteem/Self-Concept. In the adolescent age group, "physical activity can play a unique role in self-esteem enhancement"; that is, " mastery experiences and successes with physical activity can be meaningful in improving self-esteem" (Calfas & Taylor, 1994, p 417). A meta-analysis conducted by Gruber (1986) evaluated the relationship between physical activity and self-esteem in 84 articles. Although the studies reviewed typically involved children younger than the adolescent age range defined for this review, Gruber (1986) concluded that participation in directed play and/or physical education contributed to the development of self-esteem in elementary age children. Moreover, he noted that the greatest effects were for children with disabilities as compared with *normal* children and although all physical activities were shown to have a positive affect, fitness activities produced the greatest affects (as compared to creative, skill, or sport-based activities). These results suggest that biological factors may be important for self-esteem enhancement. In a more recent study, Boyd and Hrycaiko (1997), utilized an experimental pre/post-test design to examine the impact of a physical activity intervention package on the self-esteem of pre-adolescent and adolescent females (9 - 16 years). The intervention package involved three components, including physical activity, education, and self-report. They found that the most noticeable effects of the intervention occured in the pre-adolescent age group; specifically those with low self-concepts. However, although not statistically significant within the older age group, the results indicated that

all individuals with low self-esteem benefited from the intervention.

On the premise that physical fitness leads to the development of the whole person, McGowan, Jarman, & Pedersen (1974) investigated the effects of a success-oriented endurance training program on self-concept of seventh grade boys. Following an 18 week program the experimental/exercise group experienced a positive within group change in cardiovascular fitness as well as a significant improvement in self-concept. Similarly, a case study by Finocchiaro & Schmitz (1984) concluded that a six week exercise program lead to improvements in self-esteem of an emotionally disturbed adolescent. In a study investigating the psychological impact of aerobic exercise on delinquent adolescent males, MacMahon et al. (1988) found measured, although not statistically significant, improvements in self-concept. Holloway, Beuter, & Duda (1988) examined the effects of a weight training program, designed to maximize physical strength, on measures of self-efficacy, and body attitudes of adolescent girls. Participants were randomly assigned to either an experimental/strength treatment group (group 1), a control group (group 2), or a mild aerobic activity (group 3). Following the 12 week strength training program, group 1 demonstrated a significant improvement in strength (+40%), weight training efficacy, outcome estimates of pounds to be lifted, confrontation efficacy, and total self-efficacy. In addition, weight trainers experienced significant improvements in more general dispositional attitudes and confidence levels about their bodies, and about overall effectiveness in life. Pre and post-test measures did not change, or worsened, for groups 2 and 3. Holloway et al. (1988) concluded that strength training can increase self-efficacy and general self-esteem of adolescent girls.

In an attempt to explain participation rates in sport among adolescent females, Foon (1989) investigated the importance of self-esteem, locus of control and affiliation patterns. In sample of 779, tenth grade students, 72% reported that they participated in after school sport. Utilizing the Piers-Harris Children's Self-Concept Scale, Foon (1989) found that high self-esteem was positively related to participation in sport. Foon (1989) also concluded that those with high family affiliation patterns and an internal locus of control were more likely to participate in sport. Consistent with these findings are the conclusions drawn from Brown et al. (1992). Brown et al. (1992) found that participants who engaged in a 9 week running/aerobic exercise program, demonstrated significant improvements in self-efficacy, greater participation in athletics, and higher levels of fitness than controls.

The findings of the above review of literature related to self-esteem and physical activity in the adolescent population, hold consistent with those from the younger child and adult populations (Gruber, 1986; Sonstroem, 1984).

Peer Relationships and Social Interaction. "Achieving independence and attaining a sense of identity interact in a complex manner during the adolescent period" (McCabe, Roberts, & Morris, 1991). Since the adolescents' peers typically share similar experiences/pressures, the peer group provides an invaluable source of support and identification (McCabe, et al., 1991). A number of authors have proposed the beneficial role of sport as a socializing vehicle for the development of supportive friendships, however few have conducted empirical investigations (Weiss, Smith, & Theeboom, 1996). In an attempt to explore the positive dimensions (i.e., quality of friendships, peer

acceptance and the development of social competence) of friendship perceived by children and adolescents within the social context of sport, Weiss et al. (1996) interviewed 38 participants ranging in age from 8 to 16 years. In general, all the participants were active in sports and physical activity in both recreational and competitive levels. Each participant engaged in a three part interview. The first portion consisted of questions related to the participants' best friend in sport. The second part consisted of questions related to the participants best friend in sport. The final portion of the interview allowed the participants to make additional comments about their best friend. After analysing the comments made by the participants, Weiss et al. (1996) discovered 12 positive friendship dimensions. They included: companionship ("being out together") as cited by 95% of the participants; pleasant/play association (enjoying an association with one's best friend) as cited by 87% of the sample; self esteem enhancement (saying or doing something to increase one's feelings of self worth) as cited by 81%; help and guidance (assistance and tangible support) as cited by 71%; prosocial behavior (saying or doing something that conforms to social convention) as cited by 76%; intimacy (mutual feelings of a close personal nature) as cited by 71%; loyalty (sense of commitment) as cited by 71%; things in common (similarity of interests, activities and values) as cited by 63%; attractive personal qualities (positive personal characteristics) as cited by 58%; emotional support (feelings or expressions of concern for one another) as cited by 45%; absence of conflicts (refraining from arguments, fights, or judgmental attitudes) as cited by 39%; and conflict resolution (getting over fights) as cited by 16% of the sample. Weiss et al. (1996) also found negative dimensions of friendship, however

they did note that negative events occurred "sometimes" or "infrequently". The negative dimensions included: conflict (behaviors that caused disagreement, disrespect, or dissention among friends) as cited by 42%; unattractive personal qualities (undesirable personality or behavioral characteristics) as cited by 37%; betrayal (actions of disloyalty or insensitivity) as cited by 16%; and inaccessible (infrequent opportunities to get together) as cited by 3 of the 38 participants. Weiss et al. (1996) concluded that the diversity and quantity of responses suggest that the sport domain is closely linked to the development, maintenance, and enhancement of peer relationships.

Physiological. In a review of the effects of physical exercise training, Godfrey (as cited in Bale, 1981) concluded that the improvements which occur in children after training are similar to those seen in adults. Similarly, Bale (1981) supported these findings and suggested that both girls and boys can improve performance as a result of increased physical activity throughout adolescence.

In an attempt to examine the effects of a cross-country running program on pre-adolescent girls, Brown, Harrower, & Deeter (1972) followed a group of twelve girls (8 to 13 years) through a season of cross-country training and competition. Runners were tested prior to training and again after 6 and 12 weeks of training. In general, training sessions were held four or five days a week and lasted from one to two hours. The results clearly indicate that the functional adaptability of preadolescent girls to endurance training is the same or perhaps better than that seen in older adolescents and adults. By week 6, maximal oxygen uptake (VO2 max) had increased by 18% and 26% by 12 weeks of training. Henri, Vanfraechem, & Vanfraechem-Raway (1978) evaluated the effects of

a 4 month training program on aerobic capacity of 20 female participants aged 12 to 14 years. Group one was sedentary (S) and group two was active (A). The girls of group A engaged in a three day a week training program. Henri et al., (1978) found a significant improvement in heart, respiratory, and muscular fitness in group A. A more recent study by Mahon & Vaccaro (1989) examined ventilatory threshold and VO2 max. in 16 male children (ages 10 to 14 years) following an 8 week endurance training program. The endurance training program consisted of running 4 days/week for 8 weeks and a combination of continuous steady state running (2 day/week at 70-80% VO2 max) and interval training (2 days/week at 90-100% VO2 max) was employed. Following the training period there was a significant increase in ventilatory threshold (19.4%) and VO2 max (7.5%) for the experimental group (n=8). Mahon & Vaccaro (1989) concluded that changes in ventilatory threshold and aerobic capacity can be improved in young persons provided that training meets the appropriate criteria for frequency, duration, and intensity.

A recent review by Baxter-Jones and Helms (1996) examined the growth and development of young athletes across four sports, gymnastics, soccer, swimming, and tennis. They found no evidence to suggest that intense training adversely affected growth or sexual development and that the incidence and severity of injuries was low. They also found that training has many beneficial effects, including aerobic power development and muscular strength. Moreover, any negative effects of intensive training were outweighed by the many social, psychological and health benefits that serious commitment to sport brought to these young individuals.

Appendix F

Relationship Between Exercise and Psychosocial Well-Being in the Healthy Adolescent Population

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Boyd, K.R., & Hrycaiko, D.W. (1997)	181 females (9-16 yrs)	Experimental Pre/post-test	6 wk training program emphasizing cooperative physical fitness (incl. strength and cardio-vascular training). Exercise program incl. an educational component.	Self-Description Questionnaire I & II	Pre-adolescent (grades 4&5) low self-esteem & low physical self-concept groups benefited from the intervention. Pre-adolescent girls experienced the most significant changes. Overall, low self-esteem individuals benefited from the intervention.
Calfas, K.J., & Cooper, D. (1996).	44 females ($\bar{x}$ age=15.7)	Randomized Control	Group 1: 10hrs/wk of class instruction. Group 2: 10hrs/wk of class instruction plus 10hrs/wk cardiovascular training.	Harter's Self Perception Profile	Improvements in athletic competence among trained girls only. Overall improvement in physical appeal & global self-worth for both groups combined.
Weiss, M., Smith, A., Theeboom, M. (1996).	19 male & 19 females (8-16 yrs).	Retrospective.	See psychological measures.	One-on-one interview which consisted of 3 parts: Part 1: contained questions about the participants background & sport participation history. Part 2: contained questions about the participants best friend in sport. things in common (63%); attractive Part 3: allowed for additional comments about one's best friend.	Found 12 positive dimensions of friendship: compainionship (95%); pleasant/play association (89%); self-esteem enhancement (87%); help & guidance (79%); prosocial behavior (76%); intimacy (71%); loyalty (71%); personal qualities (58%); emotional support (45%); absence of conflicts (39%); conflict resolution (16%). Found 4 negative dimensions of friendship: conflict (42%); unattractive personal qualities (37%); betrayal (16%); inaccessible (3 of the 38 participants).

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Weiss et al., (1996) cont'd					Concluded: diversity and quantity of responses suggest that the sport domain is intimately related to the development, maintanence, and enhancement of peer relationships.
Brollier, C., Hamrick, N., & Jacobson, B. (1994).	4 male inpatients all diagnosed with major depression. (12-18yr)	Pilot study, modified single systems design.	Exercise program consisted of brisk walking & running. It met 3X/wk for 65 days. HR 70-80% maximum. Self report questionnaire used to determine previous exercise history & expectations of exercise program.	Mood was assessed using the Beck Depression Inventory (BDI).	All subjects lacked a history of regular sports participation or exercise routines. Ss 1: initially withdrawn, as program progressed he became less inhibited; ↓aggression; ↑ display of mastery skills; & showed greatest ↓in depression scores. Ss 2: attendance was inconsistent, but did show a slight ↓in depression. Ss 3: initial BDI score of 10 dropped to 0 by day 50 (physical complaints prevented Ss 3 from actively participating in all running, but he continued to attend & performed stretches & interacted. Ss 4: displayed ↑ energy & concentration BDI scores dropped from 4 (initial) to 0.
Brown, S.W., Welsh, M.C., Labbe, E.E., Vitulli, W.F., & Kulkarni, P. (1992).	11 adolescent in-patients & controls; (M=15.6 yr)	Experimental.	Subjects participated in a 3 day/wk running/ aerobic exercise program & continued with regularly scheduled physical activity during rest of week for 9 weeks. Controls participated in regularly schedule physical activity classes during the 9wk program. Exercise measures included: (a) time to complete a one-mile run; (b) resting, exercise, & recovery HR; and (c) BMI.	Psychosocial measures included: (a) Beck Depression Inventory (BDI); (b) Profile of Mood States (POMS); & © a self report measure on self-efficacy.	↑ self-efficacy, greater participation in athletics, & higher self reports of fitness than by controls. By 4 ½ wks subjects showed ↓ depression, ↓anger, ↓ anxiety, ↓ exhaustion, ↓confusion, & ↑ self-efficacy (Noted that the female adolescents were primary contributors to these findings). Analysis of physical measures showed a ↓RHR for treated girls at midevaluation

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Norris, R., Douglas, C., & Cochrane, R. (1992).	Study 1 147 students (70 male, 77 female) ranging from 13 - 17 years.	Retrospective.	Self Administered Questionnaire to determine current levels of physical activity (mild, moderate, strenuous).	Self report measures included: Life Events Questionnaire (LEQ); Seriousness of Illness Rating Scale (SIRS); Perceived Stress Scale (PSS); & Multiple Affect Adjective Check List.	↑ exercise scores consistently correlated with ↓scores for psychological measures. Significant relationships found between high exercise scores & low perceived stress & low depression. ↑ LE →↑ SIRS; ↑LE also associated with ↑ perceived stress, anxiety, depression, & hostility.
	Study 2 80 students incl: 22 high intensity, 19 mod. intensity, 19 flexibility. & 20 controls.	Experimental.	Training sessions lasted 25-30 minutes. High intensity group maintained 70-75% MHR. Moderate intensity group maintained 50-60% MHR. Flexibility group completed a recognized protocol for flexibility training with a minimal increase in heart rate. Fitness levels assessed by Louisiana State University step-test	As in study 1.	Resting, exercise, & recovery heart rate significantly ↓ in high intensity group. ↓ diastolic BP in high intensity group. High intensity reported ↓PS as well as weakened relationship with PS, anxiety, & depression in comparison to other groups.

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Covey, L.A., & Feltz, D.L. (1991).	149 sophomore, Jr. & Sr. adolescent women.	Retrospective.	Physical Activity Questionnaire (PAQ) to determine past & present levels of physical activity on a scale of 1 (very inactive) to 6 (very active). Responses were used to create 4 activity groups: 1. Physically active group: present activity scores were 4 or above; 2. Physically inactive: scored 3 or below on present activity; 3. Decreased activity: those who reported a present activity level that was 2 or more pts below their past activity level rating; and 4. Increased activity: those who reported a present activity level that was 2 or more pts above their past activity level rating. PAQ also used to determine subject's perceived physical ability and attractiveness.	Offer Self-Image Questionnaire (OSIQ) A self-descriptive personality test used to assess the subject's sense of emotional & physical well-being as well as self-perceived sense of personal mastery & control in her environment. Born Sex Role Inventory (BSRI) Used to measure masculinity & feminity.	Physical activity associated with healthier psychological functioning, greater perceived physical ability, higher masculinity & feminity, & healthier emotional expression and control .
Foon, A.E. (1989).	779 10th grade, female, students (avg. age 15 yrs).	Retrospective.	Sports participation was obtained by requesting participants to indicate whether or not they participated in after school sport, and if they did what sports were they involved in.	Piers-Harris Children's Self-Concept Scale; Nowicki and Strickland's locus of control scale for children; and affiliation patterns were assessed from measures adapted from Richmond (1985).	High affiliation patterns with peers was negatively associated with sports participation, while high family affiliation was associated with sport participation. High self-esteem positively related to sport participation. External locus of control negatively related to sports participation.

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Brown, J.D., & Siegel, J.M. (1988).	212 females in grades 7-11.	Longitudinal.	Exercise levels were assessed by self-report, participants were asked to recall specific physical activities over a short period of time.	Life Events Survey assessed impact of stress provoking circumstances. Modified version of the Seriousness of Illness Scale was used to assess physical health.	Most common forms of exercise were: aerobics, calisthenics, running, tennis, & swimming. Stress scores were inversely related to health; that is, the negative impact of stress on health ↓as the amount of time spent in vigorous physical activity ↑.
Holloway, J.B., Beuter, A., & Duda, J.L. (1988).	27 high school females (M=16yr).	Quasi-Experimental.	Physical Strength & Efficacy Test was designed to measure situation-specific outcome & self-efficacy estimates about wt training. Group 1: Wt training group (12 weeks) Group 2: No activity control Group 3: Mild activity control (CV fitness) Group 1 trained 3X/wk for 1 hour; the 4 core training exercises were the free wt olympic style parallel back squat, bench press, behind-the-neck standing shoulder press, & bentover rows. Group 3 was selected from a separate high school and were members of an elective figure improvement class which emphasized CV fitness.	Physical Self-Efficacy Scale Eating Disorder Inventory (EDI)	Overall strength ↑ 40%. Significant ↑ in wt training efficacy, outcome estimates of pounds to be lifted, confrontation efficacy, other efficacy, & total self-efficacy. All variables from physical self-efficacy ↑ significantly: perceived physical ability physical self presentation confidence, & overall physical self-efficacy. (EDI) all wt training participants showed ↑ control over their lives. Pretest-posttest measures did not change or worsened in groups 2 & 3.

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
MacMahon, J.R. & Gross, R.T. (1988).	69 incarcerated males in juvenile detention; (14-18yr)	Experimental.	Group 1: Aerobic program; 40 minutes of sustained exercise 3 days/week for 3 mo. (Incl: long distance running, vigorous & vigorous basketball) HR was↑ to 160 bpm. Group 2: Comparison exercise program; similar in duration & frequency, but avoided prolonged ↑ in heart rate (incl: baseball, volleyball, basketball foul shot contests, instruction in wrestling). Cardiovascular fitness was assessed by submax. exercise testing using a cycle ergometer.	Piers-Harris Children's Self-Concept Scale (Piers) Beck Depression Inventory (BDI)	3 mo: significant ↑ in mood (P<.05) & physical fitness (P<.001) among those who participated in the aerobic program. Also showed an ↑ in self-concept scores, but NS (P=.055). Improvements in BDI and self-concept occurred independently of changes in physical fitness.
Brown, J.D., & Lawton, M.L. (1986).	220 students (11-17 years).	Retrospective.	A self-report questionnaire asked subjects: (1) how often do you engage in organized sports and (2) how often do you engage in non-sports exercise? Questions were rated on a 4 point scale (1=hardly ever to 4=almost every day). They were also asked to report the intensity and frequency of their exercise.	Life Events Questionnaire; Serious of Illness Rating Scale (SIRS); & the Multiple Affect Adjective Checklist (MAACL-D).	Stressful life events were associated with disturbances in adolescent somatic health ↑ stress → ↑ physical illness. Frequent vigorous exercise associated with ↓levels of depressed affect. Debilitating effects of high life events stress was greater among low exercisers. Life stress had a significant negative impact on well-being of persons low in exercise (p=.0001).

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Psychosocial Measures	Results
Finocchiaro, M.S. & Schmitx, C.L. (1984).	Inpatients of a state mental hospital, 12-17 years.	Case Study.	Six week exercise program. Participants met for one hour/week for the first 4 weeks and biweekly for the last 2 weeks. The initial 4 week period consisted of a calisthenics program, the last 2 weeks consisted of aerobic dancing.	One-on-one interview.	Donna was admitted with severe depression & suicidal tendencies. She was a shy, quite, & exhibited a lack of self-confidence. She was under drug and group therapy and had individual counselling sessions. She attended all exercise groups. After 2 meetings she began to participate verbally & become more extroverted. By week 6 she had ↑ interested in her appearance & had a better self-image. She showed ↑ self-esteem & ↓ depression.
McGowan, R.W., Jarman, B.O., & Pedersen, D.M. (1974).	37 male, 7th grade students.	Experimental.	Exercise group: endurance/running training 3 or 4X/wk for 18 wks. On nonrunning days, subjects participated in various competitive activities incl: floor hockey, basketball, football & volleyball. Every 3-4 wks the exercise group competed against controls. The endurance group was positively reinforced for each activity - told that they won each activity. Control group did not participate in physical education classes. Cardiovascular fitness was assessed by the Cooper 12 Minute Run.	Tennessee Self Concept Scale Sociogram: asked students to indicate their 5 best friends. It was scored by the number of times each subject was was selected as a best friend. This was used as a measure of peer approval.	Following the 18 wk program the exercise group experienced a positive within group change in CV fitness ($P<.005$). Self-efficacy also ↑ ($p<.05$). There was no ↑ in peer approval.

Appendix G

Exercise and Adolescent Cancer Population

Physiological Well-Being. As the number of childhood cancer survivors grow, more and more health professionals are becoming increasingly aware of the long term complications of the treatments used to save their lives. With the use of more intensive protocols and the introduction of anthracyclines (chemotherapeutic agent), acute and chronic cardiotoxicity has become a prevalent side effect (refer to Appendix G for a thorough study review; see Appendix H for study summary tables and a more detailed overview of the authors, sample, design, exercise interventions and measures, dependent measures and results).

In an attempt to differentiate between the effects of deconditioning secondary to chronic illness and from the long term cardiotoxic effects secondary to anthracyclines, Sharkey et al., (1993) studied the impact of a 12 week aerobic conditioning program on childhood cancer survivors. Ten cancer survivors, all of whom received anthracycline therapy, were enrolled in a twice weekly exercise program. Prior to beginning the program all participants completed a questionnaire to assess subjective exercise tolerance and individual and family exercise history. Baseline functional assessments demonstrated that all participants had an increased percent body fat and reduction in exercise time, peak oxygen uptake, and ventilatory anaerobic threshold. Following the twelve week program all participants reported that they had benefited from the program and that their exercise ability had improved. Although no subjects demonstrated a significant decrease in percentage of body fat, total exercise time increased an average of 13%, peak oxygen

uptake increased by 8% and ventilatory threshold increased by 14%. Sharkey et al. (1993) concluded that although aerobic conditioning does not completely reverse the residual abnormalities secondary to cardiotoxicity, those survivors who participated in the twelve week aerobic conditioning program developed both subjective and objective improvements in their exercise tolerance.

A similar study by Pihkala, Happonen, Virtanen, Sovijarvi, Siimes, Pesonen, & Saarinen (1995) evaluated the cardiopulmonary exercise tolerance in children and adolescents after chest irradiation and anticancer therapy. This cross-sectional study compared cardiac function and exercise tolerance of 30 childhood/adolescent cancer survivors treated with chest irradiation and anthracyclines with 38 controls (28 of which were newly diagnosed, untreated cancer patients). Pihkala et al. (1995) found that treated cancer survivors had a high incidence of subnormal systolic myocardial function and decreased exercise tolerance. They also note that myocardial damage caused by anthracyclines and chest irradiation is additive and that irradiation is known to be associated with an increased risk of coronary heart disease. Thus, the importance of being able to recognize and avoid other known coronary risk factors (e.g., smoking, excessive fat intake, and obesity).

A more recent study by Johnson, Perrault, Fournier, Leclerc, Bigras, & Davignon (1997) assessed the long term outcome (five years) of low dose anthracycline therapy on cardiorespiratory responses to submaximal exercise. Thirteen patients and 15 age matched controls completed a cycle ergometer protocol as well as two 5-minute, submaximal, cycling tests. Post test measures demonstrated that patients had

significantly lower maximal work and exercise loads. In addition, the results indicated that the stroke index was 10 to 15% lower in patients and the estimated total peripheral resistance was significantly higher in patients at rest and at any given exercise work rate than in controls. Johnson et al. (1997) concluded that childhood cancer survivors treated with anthracyclines demonstrate impairments of the oxygen transport system in response to mild to moderate physical activity.

Finally, Matthys, Verhaaren, Benoit, Laureys, Naeyer, & Craen (1993) assessed gender difference in aerobic capacity in adolescent cancer survivors. The results for exercise testing of a group of 18 male and 17 female cancer survivors, who had been off treatment for at least two years, and 50 age-matched, healthy adolescents were compared. In addition to exercise testing each participant was asked to complete a written questionnaire outlining their sports participation in and out of school. They found that the female patients were less involved in sports during leisure time than boys in comparison to controls and that the girls demonstrated a significantly lower maximal oxygen consumption. No difference was found for the male cancer survivors. Matthys et al. (1995) concluded that when compared to controls, aerobic fitness after cure for cancer is lower in females than in males. They add that a more sedentary lifestyle on the part of the girls may attribute to these gender differences and that girls, in particular, should be encouraged to exercise following treatment.

The effects of cardiotoxicity have been well documented, however some effects of treatment have a specific impact on lung function. Jenny et al., (1995) examined the extent of pulmonary damage resultant from cancer therapy and any affect it might have on

exercise capacity. Jenny et al. (1995) compared 70 childhood leukemia survivors and a group of age-matched controls. Following exercise testing, a significant impairment of maximal exercise capacity was found in the leukemia survivors. Moreover, although no correlation was found between exercise capacity or lung function and subjective perception of impairment, 42% perceived limitations in their exercise capacity. Jenny et al. (1995) suggest that cancer survivors may underestimate their own potential because of low self-esteem, parental overprotectiveness, or simply because they may participate in less activities than their peers. Jenny et al. (1995) concluded that although children treated for acute leukemia have impairments in pulmonary function and exercise capacity, these impairments are mild and it is important to emphasize that the child's capacity to participate in everyday activities should not be impaired.

Turner-Gomes et al., (1996) assessed both cardiovascular and respiratory status following treatment for acute leukemia in 19 patients. Using a progressive exercise test on cycle ergometer, Turner-Gomes et al. (1996) found results comparable to the previously cited studies. They found that the patients were at risk of obesity with a mean percentage body fat of 29.7% (± 7.9%) and that exercise tolerance was below predicted values. Turner-Gomes et al. (1996) concluded that obesity and an adoption of a sedentary lifestyle may contribute to early morbidity.

In addition to cardiorespiratory complications, poor musculoskeletal performance may influence cardiorespiratory exercise tolerance in the long term. Hovi et al., (1993) assessed muscle strength of adolescent female leukemia survivors as compared to healthy, age-matched controls. Maximal isometric strength was assessed for elbow flexion, knee

extension, and hand grip and dynamic muscular endurance was assessed by a sit-up (trunk flexion) test and a push-up (arm extension) test. Hovi et al. (1993) found that the mean strength was significantly lower in the patients for elbow flexion, knee extension, arm extension endurance, and trunk flexion endurance.

Appendix H

Relationship Between Exercise and Physiological Well-Being in Children and Adolescents Following Antineoplastic Therapy

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Dependent Measures	Results
Johnson, D., Perrault, H., Fournier, A., Leclerc, J., Bigras, J., & Davignon, A. (1997).	13 patients in CCR (Tx with anthracyclines) 15 age-matched controls.	Cross-sectional.	Progressive maximal exercise test on a cycle ergometer. After 45 minute rest period, subjects completed 2 separate 6 minute, submax cycling tests.	VO2 max; cardiac index (CI); stroke index (SI); & heart rate (HR).	Patients demonstrated ↓ wt, ht, & body surface. Max. work & exercise loads ↓ in patients. MHR was similar in both groups, however patients showed ↓ VO2. SI decreased 10-15% in patients.
Turner-Gomes, S.O., Lands, L.C., Halton, J., Hanning, R.M., Heigenhauser, G., Pai, M., & Barr, R. (1996).	19 patients diagnosed with childhood ALL in remission for ≥ 1 year. 7 determined to be at a standard risk of relapse & received low dosages of doxorubicin. 12 at high/very high risk of relapse & received higher dosages of doxorubicin.	Retrospective.	Progressive exercise test to symptom-limited exhaustion using a cycle ergometer. Leg muscle function analysed during a 30 sec. maximal effort on an isokinetic cycle ergometer.	Self administered questionnaire designed to identify CV compromise on exertion & any factors which may influence the results ie. smoking or asthma. Other assess. incl: anthropometric measures, echocardiography, pulmonary function studies, & plasma protein analysis.	Most frequent c/o SOB on exertion Anthropometric assess. were available in 14 pts - found an ↑ in ideal body wt relative to age matched controls. Also noted that the patients are at ↑ risk of obesity as exercise tolerance was below predicted values. Obesity & a sedentary lifestyle may contribute to future CV disease. 12 patients completed the exercise test, no difference in heart rate response found between SR and HR/VHR. However, those patients who received ↑ dosages of

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Dependent Measures	Results
Turner-Gomes, et al. (1996) cont					doxorubicin showed ↓ shortening fraction. Due to non-compliance only 11 performed leg muscle function tests, no difference found between SR & HR/VHR groups.
Jenney, M., Faragher, B., Morris Jones, P., & Woodcock, A. (1995).	70 patients diagnosed with childhood ALL or AML now in remission. Age matched controls.	Cross-sectional.	Exercise test was performed on an Rodby cycle ergometer. VO2, HR & ventilation (VI) were measured.	Questionnaire to determine past history of respiratory disease/ difficulties and to identify any personal habits that may interfere with the results eg. smoking. CV assess. 12 lead ECG. Pulmonary function incl: forced expiratory volume (FEV1); forced vital capacity (FVC); residual volume (RV); functional residual capacity (FRC); intrathecal gas volume (ITGV); airway resistance (RAW); specific conductance (SGAW); total lung capacity (TLC); max. flow volume loops; single breath carbon monoxide diffusing capacity (DLCO); & gas transfer.	50% of children had hx of chest infection during or post therapy. Endocrine abnormalities noted in 15 patients; 10 showed ↓GH; & 5 were on hormone replacement therapy. No differences noted in personal habits or respiratory complaints. However, patients reported ↑ effort intolerance. Cardiac function: ejection fraction & fractional shortening ↓ in patient Pulmonary function: patients showed ↓FEV1, FVC, TLC, & DLCO. Significant ↓ in exercise in patients. ↓ Wmax, VO2 & VI max.

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Dependent Measures	Results
Pihkala, J., Happonen, J., Virtanen, K., Sovijarvi, A., Siimes, M. Pesonen, E., & Saarinen, U. (1995).	30 children & adolescents treated for cancer & had received chest irradiation. (28 pts also received tx with anthracyclines) 38 controls; including 10 healthy and 28 newly diagnosed, untreated cancer pts with no other systemic abnormalities.	Cross-sectional.	Cardiac function and exercise tolerance were evaluated by electrocardiography, echocardiography, radionuclide (RL), cineangiography, & exercise testing using a cycle ergometer & measuring exchange analysis.	Cardiac function & exercise tolerance.	Echocardiography: Left ventricle contractility abn. in 47% of patients. RL: pts ↓ LV EF at rest. Subnormal ↑ in LV EF during exercise noted in 30% of patients (O% noted in controls). Pts ↓ exercise - ↓work max. & ↓VO2 max.
Hovi, L., Era, P., Rautonen, J., & Simes, M.A. (1993).	43 female pts diagnosed with leukemia & off therapy for ≥ 1 year 69 age and gender matched controls.	Cross-sectional.	Assess. Of maximal isometric strength for elbow flexion , knee extension & hand grip. Muscular endurance of trunk flexors assessed by sit-up test & of arm extensors by push-up test. Self report questionnaire to assess current exercise type, intensity, & frequency. Graded: Almost daily; 2-3X/wk; ~1X/wk; 1-3X/mo; less than 1X/mo; Never.	Muscular strength and endurance. Anthropometric assess. incl: ht, wt, & body mass index.	↓ in elbow flexion & knee extension strength; ↓ arm extension & trunk endurance in patients. Those patients who received TBI had the greatest impact on muscle strength. Mean ht of patients 6.5 cm shorter and mean wt 4.8 kg lighter. No difference found in amount of leisure activity between patient & controls, however the quality of activity was not assessed.
Sharkey, A.M., Carey, A., Heise, C.T., & Barber, G. (1993).	5 male & 5 female cancer survivors at time of study 19 ± 3 years, & at time of diagnosis 8 ± 4 years.	Quasi - Experimental.	Prior to intervention all patients completed: (a) A self-administered questionnaire to assess subjective exercise tolerance & individual & family exercise activities; (b) Baseline spirometry & percent body fat; &	Exercise tolerance & cardio-pulmonary function.	*Prior to intervention*: 2 patients were unsure of their exercise ability; 4 rated it as below avg.; 3 rated it as avg.; & 1 as above avg.

Study/Year	Sample Size	Design	Exercise Intervention/Measure	Dependent Measures	Results
Sharkey et al. (1993) cont	Diagnosis included: ALL, Ewings Tumor, Rhabdomyosarcoma, Neuroblastoma, & Wilm's Tumor. All received anthracycline therapy & 9 of the 10 received radiation.		(c) A maximal cardiopulmonary exercise test (measures incl: oxygen uptake, CO2 production, respiratory quotient, resp. rate, tidal volume, minute ventilation, BP, & cardiac output). Following baseline assessments pts then participated in a 12wk, twice weekly exercise program: Week 1-2: 45 min. at 60% MHR Week 3-4: 50 min. at 70-80% MHR Week 5-6: 60 min. at 70-80% MHR Week 7-12: 60 min. at 70-80% MHR; with 1 hr of home exercise introduced. Each exercise session included a 15 min. warm-up and a 15 min. cool-down.		% Body fat ↑ in both in both males and females. Exercise testing showed ↑total exercise time, peak O2 uptake, & anaerobic threshold. Cardiac index mildly ↓. *Post-intervention*: All patients reported ↑ exercise ability. % Body fat remained unchanged. Total exercise time ↑ on avg. by 13%; ↑ peak oxygen uptake by 8% & ventilatory threshold by 14%. No significant changes noted for exercise HR, cardiac SV, or systemic vascular resistance.
Matthys, D., Verhaaren, H., Laureys, G., Naeyer, A., & Craen, M. (1993).	18 males (11-19 years), 17 females (10-18 years). Off tx for at least 2 yrs. 12 males & 11 girls received anthracyclines. No patients pts received mediastinal irradiation. Control groups: For exercise comparisons, 50 age-matched, healthy adolescents. For questionnaire, 58 students 12-18 years.	Experimental.	Exercise testing performed on cycle ergometer. Daily physical activity assessed by self admin. questionnaire. Asked to answer two questions: (1) Are you involved in sports participation at school?; and (2) Are you involved in sports participation during leisure time for at least 2hr a week?	Aerobic capacity.	Female pts ↓ ht as compared to controls. Max O2 consumption ↓ in female pts, but not in males, as compared to controls. Female pts less involved in sports during leisure time than boys in comparison to controls.

APPENDIX I

Exercise and Cancer - A Detailed Overview.

Exercise and the Adult Cancer Population.

With modern day multimodality treatment regimes higher cure rates have been possible. Accompanying these advances has been a recognition of the importance of issues related to overall quality of life. Quality of life has been defined as "a person's sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important" (Ferrans, 1990, p. 15). Quality of life is most often described as physical, functional, psychological, and social well-being (Smith, 1996) and it has been suggested that one intervention that may address all of these dimensions in the cancer patient/survivor is physical exercise (Courneya & Friedenreich, 1997a, 1997b).

Currently there are a number of quality of life interventions to assist cancer survivors including cognitive-behavioral therapies, informational and educational strategies, individual counselling or psychotherapy, social support, and other alternative treatments (Meyer & Mark, 1995). However, as noted by Cella & Tulsky (1990), functional and physical well-being are considered to be essential dimensions of quality of life and some have suggested that the current psychosocial interventions are less likely to address these dimensions (Courneya & Friedenreich, 1997a, 1997b). In fact, a recent investigation by Courneya & Friendenreich (1997b) found that functional quality of life had the strongest correlation with overall satisfaction with life.

A recent review by Courneya & Friedenreich (in press) examined all relevant articles that investigated the impact of physical exercise and quality of life outcomes (e.g., physical, functional, emotional, and social well-being) in cancer survivors. A total of 23 empirical studies

published between 1980 and 1997 were found and reviewed. The authors, sample, design, exercise intervention and measurement, outcome variables and measures, and results for each study can be found in Table 1 of Courneya & Friedenreich (in press).

Despite some of the methodological limitations (e.g., sample, design, exercise intervention and measures, and outcome variables and measures) of the present research, overall, the findings have consistently demonstrated that physical exercise has a positive effect of quality of life following cancer diagnosis (Courneya & Friedenreich, in press). The physical and functional benefits that have been demonstrated include improvements in functional capacity, muscular strength, flexibility, body composition, hemoglobin level, nausea, fatigue, and natural killer cell activity. The psychological and emotional benefits that have been demonstrated include positive changes in personality functioning, locus of control, mood states, competence, self-esteem, general quality of life, and satisfaction with life.

Exercise and the Adolescent Cancer Population

Unfortunately, physical exercise has not received the same attention as a quality of life intervention with adolescent cancer patients as it has with adults. Nevertheless, related research has shown that exercise in healthy adolescents improves self-esteem and contributes to positive family affiliation (Foon, 1989), decreases the negative impact of stressful life events (Brown & Siegal, 1988), increases self-efficacy (Brown et al, 1992), decreases feelings of depression and anxiety (Norris, Douglas, & Cochrane, 1992), and improves physiological functioning (Bale, 1981). Moreover, three studies were found which addressed the psychosocial needs of children with cancer in a summer camp setting (Swensen, 1988; Shields, Abrams, & Siegel, 1985; Smith, Gotlieb, Gurwitch, & Blotcky, 1987). Although, the purpose of the reports were not to directly

assess the impact of exercise on psychological well-being, the nature of a summer camp is based heavily on physical activities (e.g., swimming, obstacle courses, hiking, fishing). Shields et al. (1985) noted that an advantage of a camp program is that children are removed from those who they depend on most. Consequently, they find new ways to meet the challenges of the new environment while at the same time gaining independence, self-confidence, and developing a new support network of friends. Swensen (1988) suggests that summer camps allow for an emphasis of normalcy of each child who attends, promotes opportunities for mastery and efficacy in peer relationships, elevates self-esteem, and provides short term relief from anxiety and depression. Finally, Smith et al. (1987) found that a summer camp experience promoted an increase in the children's social and physical activities and a decrease in solitary activities.

APPENDIX J

The Question of Generalizability. Physical exercise, as an intervention that improves the quality of life of patients with cancer, has received only limited empirical attention within the adult population and no consideration within the adolescent population. A review of the literature which has investigated the impact of physical exercise and quality of life outcomes in adult cancer survivors (Courneya & Friedenreich, in press) demonstrates promising improvements in the patients' physiological outcomes, including functional capacity, body composition, fatigue, and nausea, as well as psychological outcomes such as locus of control, mood states, self-esteem, and well-being.

Several studies have demonstrated that as the adolescent attempts to cope with the stress of cancer and the side effects of its lengthy and intensive treatment, many experience social and emotional problems. They are forced to deal with painful and invasive diagnostic and treatment procedures, the side effects of prolonged therapies that can alter their physical and emotional well-being, repeated and prolonged absences from normal socializing activities (e.g., school), the family related stress due to the illness, and the general anxiety of living with a life threatening illness, as well as having to face the real possibility of death. These unique medical, physiological, and psychosocial needs of the adolescent cancer survivor combined with the preliminary, yet positive nature of the findings within the adult cancer population, highlights the need to replicate and extend the research on the relationship between physical activity and cancer rehabilitation within the adolescent cancer population. Furthermore, as long-term survival does not ensure an adequate quality of life, it is imperative to address what barriers/motives these

adolescents face when confronted with physical activity as well as determining what, if any, benefits are acquired from regular participation.

Date

Physician Name
Contact Information

Re: Seeking physician approval to contact patients for participation in a psychosocial quality of life survey.

Dear Dr.

My name is Melanie Keats and I am currently in my first year of a Masters of Science program at the University of Alberta. As an adolescent cancer survivor and a sport/exercise enthusiast, I am very interested in the mental benefits of leisure activities. Along with Dr. Kerry Courneya at the University of Alberta, Dr. Susan Danielsen at the Cross Cancer Institute, and Dr. Stan Whitsett of the Alberta Children's Hospital we are conducting a research study and are seeking the voluntary participation of adolescent cancer patients/survivors. The study is a pencil and paper survey that will take approximately 45 minutes of the patients time. All that the patient is required to do is to complete the survey and return it in the self-addressed, stamped envelope provided for them. As this survey requires the adolescent to recall the cancer experience, two clinical pediatric psychologists (Dr. Danielsen and Dr. Whitsett) have agreed to participate in the study and will make themselves available to those who request further support.

As you have been identified as the family/referring physician I would like to ask permission to contact the following patient(s) to seek participation in this psychosocial survey:

♦

If you have any queries or hesitations or agree to grant permission to contact these patients please contact myself at my office in Edmonton (403-492-2829 or mkeats@gpu.srv.ualberta.ca). I hope to hear from you or a member of your team in the near future.

I thank you in advance for your cooperation and assistance with this study.

Sincerely,

Melanie Keats, B.Kin.
University of Alberta
E-401 Van Vliet Center
Edmonton, Alberta
T6G 2H9

Dear

My name is Melanie Keats and I am currently in my first year of a Masters of Science program at the University of Alberta. As an adolescent cancer survivor and a sports/exercise fan, I am very interested in the mental benefits of leisure activities (sport, dance, art, music, etc.). Along with Dr. Kerry Courneya at the University of Alberta, Dr. Susan Danielsen at the Cross Cancer Institute, and Dr. Stan Whitsett at the Alberta Children's Hospital, we are conducting a research study and are seeking your voluntary participation. The study is a pencil and paper survey that should take about 45 minutes of your time. All that we ask is that you complete the survey and return it in the self-addressed, stamped envelope provided for you. More details of the study and how you were selected as a possible participant are given in the informed consent. If you would like to join the study, and if you are under 18 years of age, you will first need to get your parents permission. If your parents agree to allow you to take part in this study all you have to do is complete the enclosed survey and return it to us.

We hope that you will take this opportunity to contribute to the research being conducted on cancer rehabilitation. It is only through voluntary participation in research that we increase our understanding of the disease and its treatment. As an adolescent cancer survivor I recognize the importance of your thoughts and feelings and would like to use your comments to help others like us through the cancer experience. If you have any questions or concerns about this study please feel free to contact me at (403- 492-2829) (Melanie Keats). If you would like to explore your feelings further please feel free to contact Dr. Susan Danielsen (403-432-8364) or Ms. Betsy Maguire (403-432-8344) at the Cross Cancer Institute in Edmonton or Dr. Stan Whitsett (403-229-7975) at the Alberta Children's Hospital in Calgary. Thank you for your time and support.

Sincerely,

Melanie Keats, B.Kin.
Faculty of Physical Education and Recreation
University of Alberta
E-401 Van Vliet Center
Edmonton, Alberta T6G 2H9
Tel: (403) 492-2829

Appendix M

A Survey of Quality of Life Issues in Adolescent Cancer Survivors

Investigators: Melange Keats, BKin, Dr. Kerry Courneya, Dr. Susan Danielsen, and Dr. Stan Whitsett

CONSENT FORM

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail you should feel free to ask. Please take the time to read this carefully and to understand the information.

Background Information and Purpose of the Study

Melange Keats and Dr. Kerry Courneya of the University of Alberta, Dr. Susan Danielsen of the Cross Cancer Institute, and Dr. Stan Whitsett of the Alberta Children's Hospital are doing a study on the exercise beliefs, habits, and quality of life issues in adolescent cancer survivors. Your name was selected from the Alberta Cancer Registry and the Cross Cancer Institute because you met our study requirements. Your family or referring physician was then contacted and he/she approved that we approach you for possible participation. The purpose of the study is to understand the thoughts and feelings that adolescent cancer patients have toward exercise as a possible tool to deal with cancer. This information may be useful in helping adolescents cope with cancer.

Description of the Study

Your participation in the study involves the completion of the enclosed survey and returning it to us in the self addressed, stamped envelope provided. The survey covers information concerning personal characteristics, exercise beliefs and attitudes, current and past exercise habits, and quality of life issues. The survey should take about 45-60 minutes of your time.

Risks and Benefits of Study Participation

No risk is involved if you choose to take part in this study. It is not expected that there will be any personal benefit to you. However, your participation may help to improve patient care in the long term. Information that you provide may help us understand whether exercise is a good method for helping adolescent cancer survivors cope with and recover from treatment. Completion of the survey will require you to remember your cancer experience. If you do not wish to do so, you are not required to participate. However, if you do choose to participate and find that you would like to explore your thoughts and feelings in greater detail, please call Dr. Susan Danielsen at the Cross Cancer Institute (403-432-8364) or Dr. Stan Whitsett at the Alberta Children's Hospital in Calgary (403-229-7975).

Participants Initials_____ Parents Initials_____ Date:_____

Confidentiality

If you join the study, members of the research team of the University of Alberta may want to look at your medical records as it relates to this study at the Cross Cancer Institute. This is part of the process of quality control. These organizations will treat such information with total confidentiality. This means that no records with your name will be provided to anyone else except the investigators involved in this study. You will not be identified as an individual in any report coming from this study. All material and data obtained from this study will be stored and may be used for future study without obtaining further consent from you. However, each study arising as a result of information obtained in this study will be presented for ethical approval.

Compensation Clause

In the event that you suffer injury as a result of participating in this research no compensation will be provided for you by the University of Alberta, the University of Calgary, the Calgary Regional Health Authority, or by the researchers directly involved in this study. You still have all your legal rights. Nothing said here about treatment or compensation in anyway alters your right to recover damages.

Understanding of Participants

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without jeopardizing your health care. Your continued participation should be as informed as your initial consent, so you should fell free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research please contact:

Melange Keats, The University of Alberta: (403) 492-2829
Dr. Kerry Courneya, The University of Alberta: (403) 492-1031
Dr. Susan Danielsen, Cross Cancer Institute: (403) 432-8364
Dr. Stan Whitsett, Alberta Children's Hospital: (403) 229-7975

If you have any questions concerning your rights as a possible participant in this research, please contact the Office of Medical Bioethics, Faculty of Medicine, University of Calgary, at 220-7990 or the Patient Advocate in Edmonton at (403) 492-8585.

(PRINT NAMES CLEARLY)

Name of Participant	Signature of Participant	Date
Name of Parent/Guardian	Signature of Parent/Guardian	Date
Name of Witness	Signature of Witness	Date
Name of Principle Investigator	Signature of Principle Investigator	Date

A copy of this consent form has been given to you to keep for your records and reference. The investigators will, as appropriate, explain to your child the research and his/her involvement and will seek his/her ongoing cooperation throughout the project.

SURVEY REMINDER

This is just a reminder to ask you for your support in completing the research package that you recently received in the mail. If you have already completed and returned the package, I would like to thank you for your time and support of this project.

Sincerely,

Melanie Keats, B.Kin.
Faculty of Physical Education and Recreation
University of Alberta
E-401 Van Vliet Center
Edmonton, Alberta
T6G 2H9

This part of the survey is needed to help us understand more about yourself. For this reason it is very important information. All information is held in strict trust and your name will NOT appear on any public documents. However, if you feel uncomfortable answering any of the questions, please feel free to leave them blank. Also, you may not know the answers to some of the medical questions, if so please indicate this by "do not know". Please answer the following questions based on your present status.

I) PERSONAL HISTORY

1. Age: _____

2. Sex: Male _____ Female _____

3. Grade: _____

II) MEDICAL INFORMATION

4. Height and Weight Information: Weight in pounds _____or kilograms _____.
Height in feet/inches_____or metres/cent._____.

5. Month and Year of Diagnosis: _____.

6. What Type of Cancer Did/Do You Have:: _____.

7. Did Your Cancer Treatment Include Surgery? Yes No

8. If Yes, What Kind of Surgery Did You Have _____

_____.

Don't Know _____.

9. Did Your Cancer Treatment Include Other Types of Treatment (i.e., Radiation, Chemotherapy, Bone Marrow Transplant, Stem Cell Transplant)?

Yes No

10. If Yes, How Long Did It Last? ____Weeks ____Don't Know

____Still Ongoing

11. If Yes, What Kind(s) of Treatment Did You Receive and For How Long?

Type	# Weeks
_____	_____
_____	_____
_____	_____

LEISURE TIME ACTIVITIES

The following survey will ask you questions related to activities that you enjoy doing on your own free time. Please identify those activities that you enjoy most and be sure to add any activities that may not be included in the survey.

LEISURE TIME ACTIVITY SURVEY

The following questions will ask you list some of your favorite leisure-time activities that you enjoy doing in your free time. If you have a favorite activity that is not listed below, please feel free to talk about that activity.

There are a number of activities that people choose to do in their free time. What do you find the most enjoyable? Place a #1 beside your favorite activity, a #2 by your second favorite, and so on.

Listen to music	❐	Play a musical instrument	❐	Perform/Sing	❐
Draw or doodle	❐	Hang out with friends	❐	Watch T.V.	❐
Talk on the phone with friends	❐	Play computer/video games	❐	Play sports	❐
Reading	❐	Other _____	❐		

2. List 2 of your favorite musical groups or artists.

_____ _____

3. In an average week I listen to music for _____hours.

4. List 2 of your favorite T.V. programs.

_____ _____

5. In an average week I watch _____hours of T.V.

6. List 2 of your favorite computer/video games.

_____ _____

7. In an average week I play _____ hours of computer/video games

8. My favorite type of books to read are (e.g., comic books, fiction)

_____

9. In an average week I read for_____hours.

10. My favorite activity is _____ and in an average week I perform that activity for _____hours.

PHYSICAL EDUCATION/GYM ACTIVITY SURVEY

The following questions will ask you to recall your level of involvement in **physical activity/gym classes** at three different time periods in your life.

1. Before you were diagnosed with cancer.
2. During your treatment for cancer.
3. Since the time your treatment was completed.

SECTION 1

In this section we would like you to think back to the **period of time BEFORE you were diagnosed with cancer.**

Did you take part in a physical education or "gym" class: YES NO
If yes, how many times a week: _____ times (Please write in a number between 1 to 5).
If yes, how long were your gym classes: _____
If yes, did you sign up (optional/ your choice) for the course or was it a requirement (had no choice but to take part)? (Circle one of the choices below)
OPTIONAL REQUIREMENT

SECTION 2

In this section we would like you to think back to the **period of time DURING your cancer treatment .**

Did you take part in a physical education or "gym" class: YES NO
If yes, how many times a week: _____ times (Please write in a number between 1 to 5).
If yes, how long were your gym classes: _____
If yes, did you sign up (optional/ your choice) for the course or was it a requirement (had no choice but to take part)? (Circle one of the choices below)
OPTIONAL REQUIREMENT

SECTION 3

In this section we would like you to think back to the **period of time since your treatment was COMPLETED.**

Did you take part in a physical education or "gym" class: YES NO
If yes, how many times a week: _____ times (Please write in a number between 1 to 5).
If yes, how long were your gym classes: _____
If yes, did you sign up (optional/ your choice) for the course or was it a requirement (had no choice but to take part)? (Circle one of the choices below)
OPTIONAL REQUIREMENT

COMPETITIVE SPORTS SURVEY

The following questions will ask you to recall your level of involvement in **competitive sports (e.g., minor bantam hockey, ringette, little league baseball/softball/fast pitch, basketball, volleyball, tennis, football, soccer, etc)** at three different time periods in your life.

1. Before you were diagnosed with cancer.
2. During your treatment for cancer.
3. Since the time your treatment was completed.

SECTION 1

In this section we would like you to think back to the **period of time BEFORE you were diagnosed with cancer.**

Competitive Sport	# Practices/Games in a Week	Length of Season
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

SECTION 2

In this section we would like you to think back to the **period of time DURING your cancer treatment.**

Competitive Sport	# Practices/Games in a Week	Length of Season
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

SECTION 3

In this section we would like you to think back to the **period of time since your treatment was COMPLETED.**

Competitive Sport	# Practices/Games in a Week	Length of Season
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

EXERCISE PARTICIPATION SURVEY

The questions in the following survey ask you to recall your level of exercise at three different time periods in your life.

1. Before you were diagnosed with cancer.
2. During your treatment for cancer.
3. Since the time your treatment was completed.

When answering these questions, please remember to:

1. Consider a typical (average) week during the specified time period.
2. Only count exercise sessions that lasted 15 minutes or longer in duration.
3. Include any exercise you do ON YOUR OWN FREE TIME (DO NOT include school gym classes, competitive school teams, or organized/competitive sports outside of school).

SECTION 1

In this section we would like you to think back to the **period of time BEFORE you were diagnosed with cancer.**

A. STRENUOUS EXERCISE (heart beats rapidly, sweating)

(eg., running, jogging, hockey, soccer, squash, cross country skiing, judo, roller blading, vigorous swimming, vigorous long distance bicycling, vigorous aerobic classes, heavy weight training, laser tag)

Before being diagnosed with cancer, in an average week I was involved in strenuous exercise for more than 15 minutes at a stretch _____ times.

B. MODERATE EXERCISE (not exhausting, light perspiration)

(eg., fast walking, baseball, tennis, easy bicycling, shooting hoops, volleyball, badminton, easy swimming, alpine skiing, popular and line dancing, leisure skating)

Before being diagnosed with cancer, in an average week I was involved in moderate exercise for more than 15 minutes at a stretch _____times.

C. MILD EXERCISE (minimal effort, no perspiration)

(e.g., easy walking, yoga, archery, fishing, bowling, pool, shuffleboard, horseshoes, golf, darts, frisbee)

Before being diagnosed with cancer, in an average week I was involved in mild exercise for more than 15 minutes at a stretch _____times.

SECTION 2

In this section we would like you to think back to **the period of time DURING your cancer treatment.**

A. STRENUOUS EXERCISE (heart beats rapidly, sweating)

(eg., running, jogging, hockey, soccer, squash, cross country skiing, judo, roller blading, vigorous swimming, vigorous long distance bicycling, vigorous aerobic classes, heavy weight training, laser tag)

In an average week, during my cancer treatment, I was involved in strenuous exercise for more than 15 minutes at a stretch _____ times.

B. MODERATE EXERCISE (not exhausting, light perspiration)

(eg., fast walking, baseball, tennis, easy bicycling, shooting hoops, volleyball, badminton, easy swimming, alpine skiing, popular and line dancing, leisure skating)

In an average week, during my cancer treatment, I was involved in moderate exercise for more than 15 minutes at a stretch _____times.

C. MILD EXERCISE (minimal effort, no perspiration)

(e.g., easy walking, yoga, archery, fishing, bowling, pool, shuffleboard, horseshoes, golf, darts, frisbee)

In an average week, during my cancer treatment, I was involved in mild exercise for more than 15 minutes at a stretch _____times.

SECTION 3

In this section we would like you to think of **period of time since your treatment was COMPLETED.**

A. STRENUOUS EXERCISE (heart beats rapidly, sweating)

(eg., running, jogging, hockey, soccer, squash, cross country skiing, judo, roller blading, vigorous swimming, vigorous long distance bicycling, vigorous aerobic classes, heavy weight training, laser tag)

Following the end of my treatment, in an average week I was involved in strenuous exercise for more than 15 minutes at a stretch _____ times.

B. MODERATE EXERCISE (not exhausting, light perspiration)

(eg., fast walking, baseball, tennis, easy bicycling, shooting hoops, volleyball, badminton, easy swimming, alpine skiing, popular and line dancing, leisure skating)

Following the end of my treatment, in an average week I was involved in moderate exercise for more than 15 minutes at a stretch _____times.

C. MILD EXERCISE (minimal effort, no perspiration)

(e.g., easy walking, yoga, archery, fishing, bowling, pool, shuffleboard, horseshoes, golf, darts, frisbee)

Following the end of my treatment, in an average week I was involved in mild exercise for more than 15 minutes at a stretch _____times.

EXERCISE DURING CANCER TREATMENT SURVEY

1. What do you believe would have been the main advantages and disadvantages of exercising (running, swimming, cycling, volleyball) while receiving treatment (i.e., chemotherapy, radiation, bone marrow transplant)? Point form is fine.

ADVANTAGES DISADVANTAGES

2. There are a number of reasons of why people choose not to exercise. What do you feel are the biggest problems with exercising during cancer treatment ? What could be done to help people exercise? (Point form is fine).

PROBLEMS HELPFUL HINTS

3. Each of us has a number of people or groups who are very important to us. Please list the people or groups that are most important to you when you think about exercising during your cancer treatment. Only list the relationships (i.e., mother, father, sister, brother, friends, teachers, etc.) and not personal names (eg., Fred, Mary).

4. Would you be interested in participating in an organized exercise program designed for adolescents cancer patients?

YES NO

5. If yes, what kinds of activities would you find most enjoyable/fun? List in order of most fun to least fun.

A. (most enjoyable)
B.
C.
D.
E.
F.
G.
H.
I.
J. (least enjoyable)

6a. Who would you like to be exercising with, friends, other adolescent cancer survivors, or alone (circle one)?

6b. I like to exercise: at home_____at a fitness club/gym_____outdoors_____.

6c. I like to exercise: morning____noon_____late afternoon____evening____.

6d. I like to do: the same activity each time I exercise_____.
different activities each time I exercise_____.

6e. I like my activities to (select one from each pair):

_____supervised/instructed or _____unsupervised/self-paced
_____competitive or _____recreational
_____flexible/anytime or _____scheduled (set day/time)

6f. When I exercise I like to work:

Very hard (strenuous)_____ Hard (moderate)_____ Easy (mild)_____

6g . I find it very difficult being active on a regular basis.

1	2	3	4	5
Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

7. Did we miss anything? Is there anything that you would like to add? Please feel free to use as much space as you need to identify the exercise needs important to you.

Thank you for taking the time to participate in this survey. Please return your survey in the self-addressed, stamped envelope provided for you as soon as you are able. Keep one copy of the informed consent for yourself and sign and return the other copy for our records.

If while completing this survey you find that you would like to speak with someone else about your experience please feel free to contact:
Dr. Susan Danielsen (403-432-8364) or Ms. Betsy McGuire (403-432-8344) at the Cross Cancer Institute in Edmonton OR
Dr. Stan Whitsett (403-229-7975) at the Alberta Children's Hospital in Calgary
If you would like to talk more about your experiences as they relate to this study please contact me, **Melanie Keats, at (403) 492-2829.** Again, all the information you give to myself will be held in trust.

Sincerely,

Melanie Keats

Appendix R

Below is a list of statements about how you might have felt or behaved in the past week. Circle the statement which best describes **how often you have felt or behaved in these ways in the past week.**

Example:

During the past week: I watched T.V.

0	1	2	3
less than 1 day	1-2 days	(3-4 days)	5-7 days

Matt circled "2" (3-4 days) because he watched T.V. four days last week. If he did not watch any T.V. he would have circled "0" (less than 1 day). If he had watched T.V. every day he would have circled "3" (5-7days).

During the past week:

1. I was bothered by things that don't usually bother me.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

2. I did not feel like eating; I wasn't very hungry.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

3. I wasn't able to feel happy, even when my family/friends tried to help me feel better.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

4. I felt like I was just as good as other kids.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

5. I felt like I couldn't pay attention to what I was doing this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

6. I felt down and unhappy this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

7. I felt like I was too tired to do things this past week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

8. I felt like something good was going to happen.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

9. I felt like things I did before didn't work out right.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

10. I felt scared this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

11. I didn't sleep as well as I usually sleep this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

12. I was happy this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

13. I more quite than usual this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

14. I felt lonely, like I didn't have any friends.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

15. I felt like kids I knew were not friendly or that they didn't want to be with me.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

16. I had a good time this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

17. I felt like crying this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

18. I felt sad.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

19. I felt people didn't like me this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

20. It was hard to get started doing things this week.

0	1	2	3
less than 1 day	1-2 days	3-4 days	5-7 days

Appendix S

The following questions will ask you how much power that you feel that you have over your health. Circle the number which best describes **how you feel right now.**

Example:

A. I like to read comic books.

1	2	3	(4)	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

Susan circled "Agree". This means that she likes to read comic books a little, but they are not the only type of books that she enjoys. If Susan did not like to read comic books she would have circled "Disagree," "Mostly Disagree," or "Strongly Disagree".

1. If I get sick, it is my own behavior which determines how soon I will get well again.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

2. No matter what I do, if I am going to get sick, I will get sick.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

3. Having regular contract with my doctor is the best way for me to avoid illness.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

4. Most things that affect my health happen to me by accident.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

5. Whenever I don't feel well, I should talk to a medically trained professional (e.g., a doctor).

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

6. I am in control of my health.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

7. My family has a lot to do with my becoming sick or staying healthy.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

8. When I am sick, I am to blame.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

9. Luck plays a big part in determining how soon I will recover from an illness.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

10. Health professionals (doctors, nurses) control my health.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

11. My good health is largley a matter of good fortune (luck).

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

12. The main thing which affects my health is what I myself do (how well I take care of myself).

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

13. If I take care of myself, I can avoid illness.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

14. When I recover from an illness, it's usually because other people (e.g., doctors, nurses, family, friends) have been taking good care of me.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

15. No matter what I do, I'm likely to get sick.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

16. If it's meant to be, I will stay healthy.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

17. If I take the right actions, I can stay healthy.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

18. Regarding my health, I can only do what my doctor tells me to do.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Disagree	Agree	Mostly Agree	Strongly Agree

This is a chance to look at yourself. It is not a test. There are no right answers, and everyone will have different answers. Be sure that your answers show how you feel about yourself. PLEASE DO NOT TALK ABOUT YOUR ANSWERS WITH ANYONE ELSE. We will keep your answers in private and not show them to anyone.

When you are ready to begin, please read each sentence and choose an answer. There are six possible answers for each question: "True," "False," and four answers in between. There are six blanks next to each sentence, one for each of the answers. The answers are written at the top of each column. Choose your answer to a sentence and make a check mark in the blank for the answer that you choose. DO NOT say your answer aloud or talk about it with anyone else.

Before you start, there are three examples below. A student, Bob, has already answered two of these sentences to show you how to do it. In the third example you must choose your own answer and put your own check mark.

EXAMPLES:

		False	Mostly False	More False Than True	More True Than False	Mostly True	True	
1. I like to read comic books.....	1	☐	☐	☐	☐	☐	✔	1

Bob checked the blank under the answer "TRUE". This means that he really likes to read comic books. If Bob did not like to read comic books very much, he would have answered "FALSE" or "MOSTLY FALSE."

2. In general, I am neat and tidy.....	2	☐	☐	✔	☐	☐	☐	2

Bob answered "MORE FALSE THAN TRUE" because he is definitely not very neat, but he is not really messy either.

3. I like to watch T.V.....	3	☐	☐	☐	☐	☐	☐	3

For this sentence you have to choose the answer that is best for you. First you must decide if the sentence is "TRUE" or "FALSE" for you, or somewhere in between. If you really like to watch T.V. a lot you would answer "TRUE" by putting a check in the last blank. If you hate watching T.V. you would answer "FALSE" by putting a check mark in the first blank. If you do not like T.V. very much, but you watch it sometimes, you might decide to put a check mark in the blank that says "MOSTLY FALSE" or the blank for "MORE FALSE THAN TRUE."

If you want to change an answer you have marked you should cross out the check mark and put a new check mark in another blank on the same line.

For all sentences be sure that your check mark is on the same line as the sentence you are answering. You should have one answer and only one answer for each sentence. Do not leave out any sentences. Once you have started, PLEASE DO NOT TALK. Turn over the page and begin. BE SURE THAT YOU ARE PUTTING YOUR ANSWER ON THE APPROPRIATE LINE.

		False	Mostly False	More False Than True	More True Than False	Mostly True	True	
1. Nobody thinks that I am good looking	1	☐	☐	☐	☐	☐	☐	1
2. Overall I have a lot to be proud of	2	☐	☐	☐	☐	☐	☐	2
3. I enjoy things like sports, gym, and dance	3	☐	☐	☐	☐	☐	☐	3
4. I am usually relaxed	4	☐	☐	☐	☐	☐	☐	4
5. My parents are usually unhappy or disappointed with what I do	5	☐	☐	☐	☐	☐	☐	5
6. It is difficult to make friends with members of my own sex	6	☐	☐	☐	☐	☐	☐	6
7. People of the opposite sex whom I like don't like me.	7	☐	☐	☐	☐	☐	☐	7
8. I have a nice looking face	8	☐	☐	☐	☐	☐	☐	8
9. Overall, I am no good	9	☐	☐	☐	☐	☐	☐	9
10. I am lazy when it comes to things like sports and hard physical exercise	10	☐	☐	☐	☐	☐	☐	10
11. I worry more than I need to	11	☐	☐	☐	☐	☐	☐	11
12. I get along well with my parents	12	☐	☐	☐	☐	☐	☐	12
13. I make friends easily with boys	13	☐	☐	☐	☐	☐	☐	13
14. I make friends easily with girls	14	☐	☐	☐	☐	☐	☐	14
15. Most of my friends are better looking than I am	15	☐	☐	☐	☐	☐	☐	15
16. Most things I do, I do well	16	☐	☐	☐	☐	☐	☐	16
17. I'm good at things like sports, gym and dance	17	☐	☐	☐	☐	☐	☐	17
18. I don't get upset very easily	18	☐	☐	☐	☐	☐	☐	18
19. It is difficult for me to talk to my parents	19	☐	☐	☐	☐	☐	☐	19
20. Not many people of my own sex like me	20	☐	☐	☐	☐	☐	☐	20

		False	Mostly False	More False Than True	More True Than False	Mostly True	True	
21. I'm not very popular with members of the opposite sex	21	☐	☐	☐	☐	☐	☐	21
22. I am good looking	22	☐	☐	☐	☐	☐	☐	22
23. Nothing I ever do seems to turn out right	23	☐	☐	☐	☐	☐	☐	23
24. I am awkward at thinks like sport, gym, and dance	24	☐	☐	☐	☐	☐	☐	24
25. I am often depressed and down in the dumps	25	☐	☐	☐	☐	☐	☐	25
26. My parents treat me fairly	26	☐	☐	☐	☐	☐	☐	26
27. I am popular with boys	27	☐	☐	☐	☐	☐	☐	27
28. I am popular with girls	28	☐	☐	☐	☐	☐	☐	28
29. I hate the way I look	29	☐	☐	☐	☐	☐	☐	29
30. Overall, most things I do turn out well	30	☐	☐	☐	☐	☐	☐	30
31. I'm better than most of my friends at things like sports, gym, and dance	31	☐	☐	☐	☐	☐	☐	31
32. Other people get more upset about things than I do.	32	☐	☐	☐	☐	☐	☐	32
33. I have lots of arguments with my parents	33	☐	☐	☐	☐	☐	☐	33
34. I do not get along very well with boys	34	☐	☐	☐	☐	☐	☐	34
35. I do not get along very well with girls	35	☐	☐	☐	☐	☐	☐	35
36. Other people think I am good looking	36	☐	☐	☐	☐	☐	☐	36
37. I don't have much to be proud of	37	☐	☐	☐	☐	☐	☐	37
38. I try to get out of sports and physical education classes whenever I can	38	☐	☐	☐	☐	☐	☐	38
39. I am a nervous person	39	☐	☐	☐	☐	☐	☐	39
40. My parents understand me	40	☐	☐	☐	☐	☐	☐	40

		False	Mostly False	More False Than True	More True Than False	Mostly True	True	
41. I have good friends who are members of my own sex	41	☐	☐	☐	☐	☐	☐	41
42. I have lots of friends of the opposite sex	42	☐	☐	☐	☐	☐	☐	42
43. I am ugly	43	☐	☐	☐	☐	☐	☐	43
44. I can do things as well as most people	44	☐	☐	☐	☐	☐	☐	44
45. I can run a long way without stopping	45	☐	☐	☐	☐	☐	☐	45
46. I often feel confused and mixed up	46	☐	☐	☐	☐	☐	☐	46
47. I do not like my parents very much	47	☐	☐	☐	☐	☐	☐	47
48. Most boys try to avoid me	48	☐	☐	☐	☐	☐	☐	48
49. Most girls try to avoid me	49	☐	☐	☐	☐	☐	☐	49
50. I have a good looking body	50	☐	☐	☐	☐	☐	☐	50
51. I feel that my life is not very useful	51	☐	☐	☐	☐	☐	☐	51
52. I hate things like sports, gym, and dance	52	☐	☐	☐	☐	☐	☐	52
53. I get upset easily	53	☐	☐	☐	☐	☐	☐	53
54. My parents really love me a lot	54	☐	☐	☐	☐	☐	☐	54
55. I make friends easily with members of my own sex.	55	☐	☐	☐	☐	☐	☐	55
56. I get a lot of attention from members of the opposite sex	56	☐	☐	☐	☐	☐	☐	56
57. If I really try I can do almost anything I want to do..	57	☐	☐	☐	☐	☐	☐	57
58. I am a calm person	58	☐	☐	☐	☐	☐	☐	58
59. I have few friends of the same sex as myself	59	☐	☐	☐	☐	☐	☐	59
60. Overall, I am a failure	60	☐	☐	☐	☐	☐	☐	60
61. I worry about a lot of things	61	☐	☐	☐	☐	☐	☐	61
62. I enjoy spending time with my friends of the same sex	62	☐	☐	☐	☐	☐	☐	62

Appendix U

Important Sources of Social Support When Considering Participation in Leisure Time Physical Activity During Cancer Treatment

Person/Group	Number[a]	% of Response Group (n=44)[b]	Overall % (n=53)[c]
Mother	30	68.2	56.6
Friends/teammates/other survivors	30	68.2	56.6
Father	26	59.1	49.1
Siblings	24	54.5	45.3
Relatives	9	20.5	17.0
Doctors/Medical Staff	8	18.2	15.1
Themselves	2	4.5	3.8

Note: [a] = the number of participants who responded to the open-ended question regarding that specific source of support for being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix V

Barriers to Leisure Time Physical Activity During Cancer Treatment

Barrier	Number[a]	% of Response Group (n=47)[b]	Overall % (n=53)[c]
Too tired/no energy	32	68.1	60.4
Not feeling well enough/too sick	21	44.7	39.6
Laziness/no time/not worth the effort	7	14.9	13.2
No desire/motivation/too depressed	7	14.9	13.2
Interfere with broviac	6	12.8	11.3
Self-conscience about what others might think	5	10.6	9.4
Out-of-town/limited access to resources/confined to hospital	5	10.6	9.4
Limited due to amputation/surgery/treatments	5	10.6	9.4
High risk of injury (low platelet counts)	4	8.5	7.5
Other	6	12.8	11.3

Note: [a] = the number of participants who responded to the open-ended question regarding that specific barrier of being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix W

Strategies to Overcoming Barriers to Leisure Time Physical Activity During Cancer Treatment

Strategy	Number[a]	% of Response Group (n=47)[b]	Overall % (n=53)[c]
Pace yourself	7	14.9	13.2
Do something you enjoy	6	12.8	11.3
Decrease intensity of exercise	6	12.8	11.3
Just get out of bed/gym at hospital	5	10.6	9.4
Emphasize importance/benefits	5	10.6	9.4
Establish a regular routine	4	8.5	7.5
Support of others	4	8.5	7.5
Improve diet/eat better	4	8.5	7.5
Get professional advice	4	8.5	7.5
Provide a motivated group to work with	4	8.5	7.5
Just try/do what you can when you can	4	8.5	7.5
Other	6	12.8	11.3

Note: [a] = the number of participants who responded to the open-ended question regarding that specific barrier of being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix X

Enjoyable Leisure Time Physical Activities

Activity	Number[a]	% of Response Group (n=28)[b]	Overall % (n=53)[c]
Swimming	18	64.3	34.0
Basketball	11	39.3	20.8
Hiking/outdoor activities	10	35.6	18.9
Cycling	9	32.1	17.0
Volleyball	9	32.1	17.0
Baseball	7	25.0	13.2
Soccer	7	25.0	13.2
Weight Lifting	7	25.0	13.2
Aerobics	6	21.4	11.3
Football	6	21.4	11.3
Rollerblading	6	21.4	11.3
Running	6	21.4	11.3
Walking	6	21.4	11.3
Badminton	5	17.9	9.4
Hockey	5	17.9	9.4
Tennis	5	17.9	9.4
Bowling	4	14.3	7.5
Skiing	4	14.3	7.5
Dancing	3	10.7	5.7
Fishing	3	10.7	5.7
Rafting/canoeing	3	10.7	5.7
Rock Climbing	3	10.7	5.7
Skating	3	10.7	5.7
Other	23	82.1	43.4

Note: [a] = the number of participants who responded to the open-ended question regarding that specific barrier of being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix Y

Advantages of Leisure Time Physical Activity During Cancer Treatment

Advantage	Number[a]	% of Responders (n= 42)[b]	Overall % (n=53)[c]
Keeping fit/staying active	24	57.1	45.3
Improves self-esteem; help to feel more "normal"	15	35.7	28.3
Break from thinking about the disease	13	31.0	24.5
Faster recovery/regain strength	10	23.8	18.9
More energy/less tired/feel better	8	19.0	15.1
Less depressed/boost spirit	5	11.9	9.4
Helps deal with anger/stress	4	9.5	7.5
Fun	4	9.5	7.5
Being with friends and loved ones; meet new people	4	9.5	7.5
Kills time	4	9.5	7.5
Other	6	14.3	8.8

Note: [a] = the number of participants who responded to the open-ended question regarding that specific advantage of being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix Z

Disadvantages of Leisure Time Physical Activity During Cancer Treatment

Advantage	Number[a]	% of Responders (n= 42)[b]	Overall % (n=53)[c]
Makes me feel too tired	24	57.1	45.3
Too painful/makes me feel sick	11	26.2	20.8
May cause greater harm than good (e.g., bruises, bleeding)	9	21.4	17.0
No strength to exercise/too tired	9	21.4	17.0
Other	10	23.8	18.9

Note: [a] = the number of participants who responded to the open-ended question regarding that specific disadvantage of being physically active during treatment; [b] = Number of responses/total number of participants who made some form of response to the open ended question; [c] = Number or responses/total number of study participants.

Appendix AA

Leisure Time Physical Activity Preferences.

Item	Number [a]	% of Responders	Overall % (n=53)
Activity Location (n=47)			
Home	5	10.6	9.4
Fitness Club/Gym	8	17.0	15.1
Outdoors	13	27.7	24.5
All	21	44.7	39.6
Activity Schedule (n=43)			
Flexible/Anytime	27	62.8	50.9
Scheduled	16	37.2	30.2
Activity Social Choice (n=39)			
Friends	24	61.5	45.3
Other Survivors	8	20.5	15.1
Alone	6	15.4	11.3
All	1	2.6	1.9
Activity Supervision (n=42)			
Supervised/Instructed	10	23.8	18.9
Unsupervised/Self-Paced	32	76.2	60.4
Activity Preference (n=42)			
Same Activity	10	23.8	18.9
Different Activities	31	73.8	58.5
Both	1	2.4	1.9
Activity Intensity (n=47)			
Very Hard	10	21.3	18.9
Hard	33	70.2	62.3
Easy	3	6.4	5.7
All	1	2.1	1.9
Difficult Being Active on a Regular Basis (n=49)			
Strongly Disagree	5	10.2	9.4
Disagree	15	30.6	28.3
No Opinion	8	16.3	15.1
Agree	17	34.7	32.1
Strongly Agree	4	8.2	7.5

Note: [a] = number of participants who responded to the question; [b] = number of responses/total number of participants who made some form of response to the question; [c] = number of responses/total number of study participants.